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ABSTRACT

This monograph describes what worked and what did not in 15 college and university programs sponsored by the Fund for the Improvement of Postsecondary Education from 1984 to 1987. Each description includes information on the project's purpose, innovative features, evaluation, impact or changes from the grant activities, what worked unexpectedly, what did not work, available information, and what has happened to the program since the grant ended. The programs and colleges are: (1) Alverno College (Wisconsin): High/Middle School-College Teaching Partnerships; (2) Atlanta University (Georgia): Integrating Computerized Bibliographic Services into Historically Black Schools; (3) University of California-Los Angeles: A Value-Added Approach to Institutional Excellence; (4) Carnegie Mellon University (Pennsylvania): A Learner-Centered Computer Environment for Critical Reading, Reasoning, and Writing; (5) DePaul University (Illinois): Equal Educational Opportunity for Learning Disabled College Students; (6) DePaul University: Master of Arts Program for Practicing Professionals; (7) Georgetown University (District of Columbia): Interdisciplinary Education for Advanced Technology and International Public Policy; (8) Long Island University (New York): The Hellman Academy for Mathematics and Science Teacher Education Retraining; (9) Madonna College (Michigan): Educational Access for Hispanic Youth; (10) University of Missouri-Columbia: Integrating Dispute Resolution into First Year Law School Curriculum; (11) University of Missouri-St. Louis: Gateway Writing Project-Composing, Computers and Contexts; (12) University of Oregon: Microcomputing Laboratory for Integrative Learning in Physiology; (13) Salisbury State College (Maryland): The Mathematical Competition in Modeling; (14) Southern Regional Education Board: Improving the Pass Rate of Minority Students on Teacher Certification Examinations; and (15) University of Virginia: Teacher Training through Computer Simulation. (JB)

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LESSONS LEARNED FROM FIPSE PROJECTS

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Fund for the Improvement of Postsecondary Education
U.S. Department of Education

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LESSONS LEARNED
FROM
FIPSE PROJECTS

15 Directors of Reform Projects in Postsecondary Education Draw Conclusions About What Worked, What Didn't, and Why

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PREFACE

The Fund for the Improvement of Postsecondary Education (FIPSE), established in 1972 on the model of a philanthropic foundation, supports demonstrations on innovative reform ideas in postsecondary education. During its eighteen years, FIPSE has supported hundreds of campus-based reform projects, and a high proportion of these have survived the fade-out of Federal funding at their original sites, where their benefits are observed directly.

But the question remains of how to help disseminate a locally proven approach to a new campus site, where faculty and administrators are generally not acquainted with the benefits of the approach first-hand. The present monograph may be part of the answer—self-portraits of some educational pilot tests supported by FIPSE, together with what was learned by the project staff from managing them. The portraits analyze what worked and didn't work as the grantees struggled to overcome obstacles and gain permanent acceptance of their educational reforms.

But these are not quite self-portraits, even metaphorically. Dr. Dora Marcus interpreted and recast project directors' responses to survey questionnaires and talked at length with all respondents. She has reviewed project files, evaluation data, grant products, and final reports to FIPSE and asked sharp follow-up questions. Hence, while Dr. Marcus was limited ultimately by the data supplied to us by the project directors, these self-portraits have been focused and polished in cooperation with FIPSE.

The result is a rather uniform series of sketches, albeit on a diversity of topics, which we hope reform-minded college and university presidents, deans, and faculty members find useful. The project directors welcome inquiries and requests for further information about any of their projects having special relevancy to your campuses.

Charles H. Karelis, Director
Fund for the Improvement of Postsecondary Education

ABOUT THIS MONOGRAPH

The main activity of the Fund for the Improvement of Postsecondary Education (FIPSE) is conducting the Comprehensive Program, an annual grants competition. The 15 selections in this volume were based on questionnaire responses from the college and university project directors responsible for these grants. Their funding covered a period of three years, 1984 to 1987. In each case, we inquired about what activities worked and didn't work in creating change, what happened unexpectedly, and what evaluation told us about the confidence we could place in the changes.

Also we learned about the current status of these projects three years after funding ended and what they had produced that could be made available to others. Under each selection here, we refer you to the project directors themselves so that you may follow up with them directly about those ideas and products.

Special thanks to two of our favorite colleagues, Jane Spalding and Robert Shoenberg, for their careful editing and wise suggestions. And very special thanks to the project directors themselves who so ably translated their ideas into educational practices that may benefit us all.

INTRODUCTION

Meaningful improvement does not come easily to postsecondary education, especially in the realm of teaching and learning. Change can be made most readily at the margins of the academic enterprise, but deep and abiding transformation sometimes seems almost as difficult to achieve as agreement to move a graveyard.

Change for the sake of change is not the issue. There has been more than enough of that. Rather, I am thinking of the many possibilities for improving the instructional mission that are never explored because of resistance to change, which, in effect, becomes a barrier to improvement. At a time when practices and institutions outside American higher education are undergoing profound change, the Academy remains largely impervious to alteration.

The Berlin Wall topples, but a faculty reward system at major research universities that is inimical to good undergraduate teaching remains firmly in place. Disciplines split into sub-disciplines smaller than the atom. Departmental turf wars produce fiefdoms that dot the campus like the moated manors of medieval lords. Crossing the disciplines and trying to mount interdisciplinary courses and programs becomes as difficult as getting the Moslem and Christian factions to unite in Lebanon. Some colleagues and universities find that the only way to gain support for interdisciplinary studies is to create special institutes outside the restrictive departmental structure.

A curriculum replete with incoherency is the fragmented road map that guides most undergraduates through college. Like Alice in Wonderland, they undergo a series of experiences that seem remote and unrelated. They end up sampling a smorgasbord of isolated courses called an education that, beyond the major, leaves them with neither intellectual nourishment nor a sense of the connectiveness of knowledge.

While elementary and secondary schools become subject to intense review, higher education curiously is able to keep itself beyond the penumbra of scrutiny. Critics as diverse as Allan Bloom and Charles Sykes are dismissed as swiftly as a homeless vagrant who has wandered into a private club on Fifth Avenue.

The purpose here, however, is not to indict higher education. Despite its faults, it looms pure and noble on an American landscape littered with endeavors that have been consumed by greed, bad taste, and poor management. Yet, to appreciate the context in which the Fund for the Improvement of Postsecondary Education operates it is necessary to recognize the formidable challenge that confronts the agency's Comprehensive Program. Judging by the nature of the projects that FIPSE has selected for inclusion in this publication, the agency wields no magic wand.

What becomes clear in reading about the projects described on these pages, though, is that FIPSE makes a difference and, by its recognition and funding, the agency helps prod a measure of improvement. There is evidence from the reports that some projects are leading to replication and helping to introduce needed changes on a wider basis.

As this selection of projects also shows, the activities that earn support from FIPSE are diverse; so much so that at first glance they seem to defy categorization. However, I suggest that even this small sample can be sorted. Five main kinds of projects—with some overlap—emerge from the sample:

1) Minority and disadvantaged students.
2) Relationships between higher education and the schools.
3) Teaching problem solving and critical thinking.
4) Assessment.
5) Bolstering the disciplines.

Before discussing these five topics, I would like to take note of a few overarching themes. The frequency with which computers and technology in general figured in these FIPSE projects is encouraging. Higher education has not been as slow as the schools in moving into the computer age, but all of education is certainly a backwater when it comes to technology. It is as if Gutenberg invented moveable type and hundreds of years later scribes continued to letter books by hand.

Teachers and professors are not sufficiently integrating technology into instructional methods and students do not have enough access to technology to assist them in their learning and their research. Furthermore, too many students are not studying about science and technology, areas of the curriculum to which they should be exposed regardless of major.

The Alfred P. Sloan Foundation recognized this problem almost a decade ago, when it set up its new liberal arts program to provide grants, first, to private liberal arts colleges and, later, to other kinds of institutions of higher education. The aim was to make it more likely that undergraduates in all fields would develop an understanding of the problem-solving techniques and fundamental concepts which underlie modern technology, as well as to help the students grow comfortable with mathematics and computing.

This idea has not taken hold in all of higher education, as it should. Too many colleges and universities have not progressed from the point of acknowledging the value of technology to the point of preparing students to use it and understand how their lives will be affected by it. Institutional commitment is so weak that several colleges and universities in this sample, though they made technology central to the projects, provided insufficient hardware or software.

Technology itself might have been one of the categories by which I defined a group of projects, but I decided this would signal the wrong intent. It is more fruitful not to think of technology in so limited a way. Technology should be considered basic to education, just as books are. In other words, it is a mistake to try to view projects that use technology as being of a certain type. Technology should cut across the projects, whatever the goals of the projects may be. FIPSE, too, apparently is coming to adopt this view. An essay in its 1989 program book holds out the possibility that the technology section of the guidelines "will eventually dissolve into the other categories as technology becomes further entrenched in all areas."

Progress in this direction can be seen on the following pages, where, among just 15 projects, technology was used to help students of international public policy better understand the issues with which they grapple, to teach physiology, to allow composition by word processing, to give underfunded libraries greater access to bibliographic services, to create simulations, and to allow students to learn how to present reasoned arguments.

A look at the projects in terms of the five broad categories gives some hints as to possible directions in which institutions of higher education might proceed in seeking improvement. Most colleges and universities share the concerns that gave rise to these projects.

For instance, "diversity" is a word often used to describe the changing face of higher education. College-going patterns have shifted sharply during the last 25 years and one of the most striking changes has been the inclination of minority students from disadvantaged backgrounds to enter higher education. Bureau of the Census statistics show that the portion of blacks in the enrollment grew from 4.8% in 1965–66 to 11% in 1987–88. For Hispanics, the portion rose from 4.2% of the enrollment in 1976–77 to 6.1% in 1987–88.

Unfortunately, there may have been some slowing and even decline in the actual numbers of minority students enrolled in recent years. A report in early 1990 from the American Council on Education found that the rate at which blacks and Hispanics continued on from high school to college declined during the 1980's. Statistics from the U.S. Department of Education indicated in 1990, however, that minority enrollment began climbing again in the 1980's.

Is is clear by now that access alone is no assurance that students will be able to take advantage of opportunities. When the door is first thrown open, some people have to be helped across the unfamiliar threshold. FIPSE recognizes this and a fundamental theme of its work from the outset has been the promotion of access. Many students, while in high school and even earlier, do not get proper preparation for higher education. Those who persevere and make it to college sometimes are overwhelmed by difficulties, both academic and social, that truncate their education.

1

Thus, in the first of the five categories that I have identified, there is a project entitled "Educational Access for Hispanic Youth," operated by Madonna College in Michigan. This venture exemplifies the effort to strengthen the scholastic background of minority students so that they are more apt to continue on to college and, once there, succeed.

Graduation rates for minority students who enter higher education are mentioned much less frequently than enrollment rates, but glimpses of the limited data available indicate that minority college students are considerably less likely than whites to get degrees. Only 24% of black students and 20% of Hispanic students at 4-year colleges got baccalaureates within 6 years, compared with about half of white students, according to a report released early this year by the National Institute of Independent Colleges and Universities.

Getting through high school is an important first step in the educational advancement of disadvantaged minority students, who frequently have few role models to help them recognize that they can realistically aspire to a college education. Financial pressures push them toward jobs and some peers disparage education. Disadvantaged minority students may foreclose possibilities by dropping out of school.

The program run by Madonna College sought to keep youngsters enrolled in high school and, at the same time, give them more of the grounding in math, science, and English that they would need for higher education. Parents were engaged in the effort to recruit participants, who were tested so that they could be assigned for tutoring in groups of similar ability. The tutoring workshops met on Saturdays during the school year and for 6-week sessions during the summer.

This approach was by no means unique or even unusual. But the fact that it was needed and the favorable results that were reported attest to the continuing necessity to motivate students and help them gain the preparation essential for postsecondary education. What began at Madonna College for high school students of Hispanic background expanded to include blacks and Native Americans, in effect underscoring the widespread need for such programs.

The hurdles seem never to end for disadvantaged minority students. Even if they avoid dropping out of high school, make their way to college and obtain a degree, sometimes an obstacle remains in the form of an examination for graduate school or a test for professional licensing or certification. Several states in the South that test candidates for teacher licenses have found that blacks suffer a disproportionately high rate of failure, for instance.

The Southern Regional Education Board developed a FIPSE project designed to improve the pass rate of minority students, particularly those being graduated from historically black institutions, on teacher certification examinations. In part, the project called for revising the undergraduate course content to reflect the material to be covered by the test. Many of the activities were a rehearsal of test-taking skills.

It is appropriate that such a project focused on students at historically black colleges and universities. These institutions have viewed the socialization of their students as part of their mission and test taking, after all, is partially a matter of socialization. Whether or not one approves of tests, they are a reality and so long as tests exist, those who are more savvy in

taking them are going to start with an advantage. But even a grasp of test-taking skills is not enough to ensure success on tests. The program of the Southern Regional Education Board encouraged the participating colleges and universities to strengthen liberal arts education and to improve students' powers of analysis.

Most historically black institutions of higher education offer students a nurturing environment, but financial restraints frequently limit just how much colleges and universities can do for their students. It is an unfortunate irony. Students attend these institutions because they believe their needs will be better met. In spite of good intentions, however, the institutions cannot always do what they would like to do for their students.

The fiscal plight of the libraries on these campuses illustrates the problem. A FIPSE grant to Atlanta University was aimed at using technology to provide access to computerized bibliographic information via a cost-effective network and to train librarians at 15 historically black institutions to use on-line information retrieval services.

What is particularly appealing about this project is the potential for help that it offers at a time when colleges and universities must learn to accommodate financial constraints. The idea of using a network and harnessing technology on behalf of that network is one that might be applied more widely to help this group of institutions with other problems as well.

Finally, disadvantages of a different sort were featured in another FIPSE project, this one aimed at handicapped students: the learning disabled. 10% of all students in elementary and secondary schools are classified as handicapped, and the largest single category of handicapped students—about 40% of the total—comprises those with learning disabilities. Colleges and universities have done surprisingly little to recognize the special needs of learning disabled students, reasonably intelligent people whose brains process information in a manner that may make it difficult for them to read or spell or compute simple numbers.

The "Equal Educational Opportunity for Learning Disabled College Students Project" at DePaul University in Illinois was a response to the needs of this group. DePaul observed that "many students with learning disabilities can benefit from a college education, given appropriate support." And, indeed, the handful of institutions that have made special efforts have found this to be true.

Early intervention and supportive services can help enormously in what higher education can do for minority students and handicapped students. In fact, all students who eventually end up in college would be better off if colleges and universities showed an interest in their preparation long before they completed high school.

2

As recently as the early 1980's it was possible for me to comment in a book, *School and College*, that "aside from the obvious role of preparing the men and women who teach in elementary and secondary schools, colleges and universities have been reluctant to enter into partnerships designed to enhance cooperation between the two sectors."

Growing collaboration between schools and colleges was notable during the 1980's, and higher education now acknowledges a responsibility for forging such relationships. Some wonderful partnerships are thriving. FIPSE can be helpful in assisting the ventures that have the greatest prospect of being replicated. Projects can be aimed either at students in elementary and secondary schools or at their teachers and principals, through whom the students ultimately would be reached.

An essay in FIPSE's 1989 program book takes note of the rapid growth in proposals to assist teacher education as well as, presumably, projects for the professional development of teachers already in the field. Given the flux today in teacher education and professional development, FIPSE is apt to see even more proposals of this sort.

Some of the possibilities—working with elementary and secondary schools either through students or through teachers—are seen in the projects described in this publication. The program at Madonna College that offered tutoring to high school students was an obvious example of what could be done directly for students. The effort to work through teachers was seen in Alverno College's "High/Middle School-College Teaching Partnerships."

In this instance, 170 teachers in interdisciplinary teams from schools in the Milwaukee area met with college professors to consider how the teachers could become more adept at helping their students be critical thinkers. The project was more than theoretical. The participating teachers strove to figure out how to infuse the curriculum with the teaching of critical thinking.

Helping teachers translate what they learn in such sessions into curriculum units is desirable. Time after time it has been shown that colleges and universities can be most helpful to teachers when the teachers emerge from the project with a "product" that they can take back to the classroom and put to immediate use. Curriculum units designed in consultation with college professors exemplify this approach. Schoolteachers do not have the abundance of noninstructional time that college professors have for reflecting and conducting research and often must rely on others to provide the preparation that they need to embark in new directions.

One of the most significant success stories involving school-college collaboration has been in the teaching of writing. What began some 20 years ago at the University of California at Berkeley as the Bay Area Writing Project has swept the country and transformed the teaching of writing by teachers in elementary and secondary schools. The FIPSE project at the University of Missouri-St. Louis aided the efforts of the Gateway Writing Project, which dates from 1978.

In the latest version of the project, schoolteachers were brought back to campus to learn how to adapt word processing to techniques that they had learned to do with paper and pencil. In addition, their bosses—the school administrators—were taught how to form teams in their schools for disseminating these techniques through word processing.

By far the strongest link between higher education and elementary and secondary schools continues to involve the role that colleges and universities play in preparing teachers for the schools. The school reform movement of the 1980's has assured that there will be many changes in teacher education, and higher education is now making some necessary adjustments. For instance, the undergraduate education major is being eliminated on some campuses so that future teachers must major in arts and sciences. Also, a five-year program to prepare for teaching has become mandatory at some higher education institutions.

Teacher training is undergoing drastic changes across the country and this is a time for colleges and universities to consider how they can best educate the next generation of teachers. What is so exciting about this challenge is that the climate for improvement is so favorable. Years may pass before higher education again has the opportunity to be so bold in teacher education.

The Curry School of Education at the University of Virginia used a FIPSE grant to create computer simulations for training teachers so that they could get a taste of life in the classroom and rehearse for the experiences that await them. In its own way, this approach resembles the simulated cockpit in which fledgling aviators train before they soar off on their own.

"The Hellman Academy for Mathematics and Science Teacher Education Retraining" at Long Island University was an attempt to address the shortage of teachers in these two critical subject areas. Men and women already working in the schools as teachers of other subjects were retrained to teach math and science. An advantage here is that the participants already were familiar with the ethos of the schools and were not going to encounter surprises. Moreover, they were committed to teaching as a career. This freed the project of some of the uncertainties that surround efforts to lure candidates into schoolteaching from other professions or to proselytize young college students so that they will embark on teaching careers.

3

During the 1980's, teachers of all subjects in both schools and colleges came to realize that they were not equipping students with the ability to think critically and to solve problems. On one national test after another students demonstrated weaknesses in higher order thinking skills whether it was drawing inferences in reading, solving multi-step problems in mathematics or writing analytically.

A survey of college freshmen in the fall of 1989, co-sponsored by the American Council on Education, found that the portions of students feeling in need of remedial work were 22.2% in mathematics, 16.7% in science, and 14.9% in English. In 1988, remedial instruction at four-year colleges were offered by 94.7% of public institutions and 86.3% of private institutions.

Education in the 1990's must take on the task at all levels of teaching more students to become thinkers and problem solvers. This leads to the third category of FIPSE projects described in this publication, projects that work with students before they ever reach college and other projects that aid students during the undergraduate years. At either juncture, the goal of the projects was to develop thinkers who could get more out of their education.

One FIPSE project of this kind was the "Learner-Centered Computer Environment for Critical Reading, Reasoning and Writing" at Carnegie Mellon, an institution that has been a

national leader in linking computers to education. For this project, cognitive research conducted at Carnegie Mellon was used to develop a computer-based curriculum on the processes of structuring argumentative writing. Sadly, many students reach college unable to write persuasively. They have had a steady diet of short-answer and multiple-choice tests. They have seldom been asked to write papers longer than a few paragraphs. They have not honed the techniques of writing. "Even at 'better' institutions, students do not write argumentative essays well," said Carnegie Mellon.

The method used at Carnegie Mellon to help students learn to structure argumentative writing was derived from research in which experienced and inexperienced writers were questioned about the processes they were using as they wrote. The program was fashioned on the basis of the responses. What we are talking about here is guiding students through the thinking process as they write.

The University of Oregon, too, made a FIPSE grant into a vehicle to improve the thinking abilities of students. A pedagogy emphasizing open-ended problem solving was applied to the teaching of physiology. Students learned to recognize that the solution to a scientific problem proceeds down multiple pathways with competing, simultaneous hypotheses.

In this project, students had to pose hypotheses and test them. "Learning is a dynamic process of both exploration and discovery," said the University of Oregon. Yet, it is a process that curiously has barely existed in the education of so many students. Much the same concern dictated the grant that went to Alverno College to help teachers in middle schools and high schools infuse the curriculum with critical thinking.

A similar motivation underpinned the Master of Arts Program for Practicing Professionals at DePaul University's School for New Learning. In this case, the students were employees in business, social service, health care, the media and other fields. The goal was to provide them with part-time, graduate-level studies that would enhance their ability to frame and solve problems and their capacity for making decisions. Because the courses were rooted in the liberal arts, the hope was that their problem solving and decision making would be informed by tested values and ethical sensitivity.

This was a graduate program of employed adults that was linked closely to their day-to-day activities in the workplace. Using individualized learning plans, the students carried out

research projects based on actual experiences. This was an effort to transform what might otherwise have been an abstract exercise in the study of liberal values into an application of those values to living situations.

Some schools focus their efforts so extensively on teaching basic skills, especially to low achieving students, that frequently little attention is paid to challenging these students with analytical and problem solving tasks.

4

One category of grants that holds promise of expanding during the 1990's is the fourth group, those involving assessment. FIPSE has been funding assessment projects since its inception in 1972, and the agency feels that its support has helped sustain the assessment movement. I suspect that the nation is on the threshold of a new era in assessment. On the one hand, the pressure for accountability in education at all levels is going to lead to more assessment. At the same time, dissatisfaction with norm-referenced standardized tests and other assessment methods of the past is likely to spawn broad, new approaches to assessment.

The project sponsored by the University of California at Los Angeles, "A Value-Added Approach to Institutional Excellence," typified the effort to find more appropriate ways of measuring educational outcomes. The focus was on how much students actually learned from entry to exit rather than on their level of competency relative to other students. A consortium of seven institutions implemented the approach.

The project that the Southern Regional Education Board sponsored for the group of black colleges represented another way of dealing with assessment. Teacher certification examinations have shortcomings. Indeed, the states of Connecticut and California are on the brink of creating a whole new generation of tests for assessing teachers. In the meantime, though, ways must be found to make the best of what exists.

While the computer simulation that was developed at the University of Virginia for training teachers was not described in terms of assessment, the approach nonetheless has implications for assessment. All indications are that various forms of simulation will figure ever more prominently in future assessments of all sorts.

5

The fifth category, FIPSE grants for strengthening the academic disciplines and bolstering the curriculum, is ostensibly the

least exciting kind of activity because it would seem to be what one would most expect in the ordinary turn of events. Yet, what could be more fundamental to improving education?

Salisbury State College in Maryland pointed out that "undergraduate mathematics is the keystone to research and knowledge in the natural sciences, economics, engineering, computer science and other fields." To enhance mathematics, the Consortium for Mathematics and Its Applications worked through a project director at Salisbury State to sponsor an annual national contest in mathematical modeling. The math problems were open-ended and did not have a single or clear solution. Students worked in teams of three for an entire weekend to solve one problem. By the third of the three grant years, more than 150 teams from 118 higher education institutions were engaged in the competition.

At the University of Missouri-Columbia, a grant supported a project to integrate dispute resolution into the first year of the law school curriculum. What this meant was that the law students, who in most schools ordinarily get an adversarial view of a lawyer's role, learned about alternatives to litigation. They studied such other ways of resolving disputes as negotiation, mediation, and arbitration.

Project personnel also developed a textbook and instructor's manual on dispute resolution that could be used in law schools around the country, allowing professors to build on the existing curriculum. Exercises for the manual were contributed by 24 professors at 14 law schools, a step that enlarged the stake in the innovation.

Two new courses grew out of an interdisciplinary FIPSE project at Georgetown University that sought to widen the perspective of students in international public policy so as to make them more conversant in issues of technology. Advances in electronics, telecommunications, aerospace, and biotechnology were taken into consideration in weighing public policy issues in such areas as pricing policy, intellectual property rights, and data flow across borders.

A review of these five categories of grants is instructive not only in what can be learned about how the projects operated but also for what is revealed about obstacles to improvement. Summaries of some of the projects contain fairly candid explanations of the impediments. At least two important patterns are discernible.

First, some projects did not give enough attention to setting the stage for a new act. Sets and props from former productions were left in place and the stagehands and the audience were not primed for what was about to occur. An expanding body of literature is devoted to examining change in education. The findings stress the imperative of getting people who will be affected into a receptive mood and also of solidifying support and commitment in advance. This is what setting the stage for the new production should involve.

Second, the outcome of the projects described in this book leads to the discovery that certain steps must be taken to perpetuate change. Otherwise, like a sand castle built on the beach, the result of the project will simply wash away. A support structure must be set in place as educational change unfolds in order to undergird the new structures. There has to be some shoring up for the day when FIPSE and the original agents of change have departed. Not all projects merit institutionalization, but those that prove their mettle and have further contributions to make should be preserved for at least a reasonable period.

It is exciting to learn from some of the project evaluations that there were bonuses, favorable outcomes that were unexpected. Here, again, there were two patterns.

One was the surprising lack of resistance in some instances where objections were anticipated. As I stated, resistance to educational change can be neutralized by getting people ready for change. When expected resistance does not materialize even though no measures were taken to head it off, it is simply a matter of serendipity and those responsible for the project should thank the stars and do the right work in advance the next time.

The other unexpected favorable result was that some projects enjoyed a much bigger impact than was foreseen. This is a reminder that often it is not possible to anticipate the effects of a reform venture. Those who embark upon projects intended to bring improvement to higher education should be ready for success. As odd as this may sound, it is worth bearing in mind so that the project is positioned to capitalize on good fortune. The window of opportunity may remain open longer than expected, but almost always it will once again slam shut and the goal should be to have made as much improvement as possible by then.

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ALVERNO COLLEGE
High/Middle School-College Teaching Partnerships

Purpose of Project:

High school and college teachers working together proposed to improve critical thinking abilities in students by improving teaching and assessment. Critical thinking for this partnership comprises a pool of features including judgment, synthesis, analysis, reflection, questioning, problem solving, and evaluation.

Innovative Features:

While current educational journals call for locally initiated reform, few high/middle school teachers have become agents of curricular change. Charging teachers with direct responsibility for curricular reform in their schools is the central innovation in this partnership. 170 teachers in teams from Milwaukee area schools formulated specific institutionwide plans for infusing critical thinking across their schools' curriculum. Intensive two-week instructional workshops showed teachers how to design, sequence, and integrate critical thinking into curricula.

This project demonstrates that school teachers can effectively design curricular changes and assist their colleagues in implementing them. Originally, 12 schools were targeted for participation, but that number was expanded to include 22 urban, suburban, and rural middle/high schools, both public and parochial.

The program had several key features: work is collaborative between college and school educators; teams from each school are interdisciplinary; teachers give students ongoing support and feedback about their critical thinking skills; and teams monitor implementation of plans through site visits to participating schools.

Evaluation:

Each school's plan includes a variety of measures of critical thinking improvement:

- Student test data
- Sample assessments; examples of student performance
- Videotapes of classroom activities
- Teacher and student interviews and questionnaires
- Teacher and student reflective logs
- Faculty inservice and work session documentation

Impact or Changes From Grant Activities:

Twenty-two individualized school plans for integrating critical thinking across the curriculum were designed by participating teachers. Of 13 schools in the grant's first year, 11 reported 50% or more of their plans implemented by 1987. Of nine schools in the second year, eight plans were almost fully implemented by 1988. Most of the schools, then, have implemented the critical thinking plans they designed or are in the process of implementation.

Only two years have elapsed since some of the teachers implemented curricular changes in their schools, too brief a time to establish definitive test score improvements. Nevertheless, one school's early data produced some astounding results.

The comparisons made are for seventh graders over the course of six years on one measure (Iowa Tests of Basic Skills) and for eighth graders over six years on another measure (Milwaukee Public School Competency Test). Note the data do not take the same students and instructors on the same measure in two consecutive years.

At the end of the implementation year, the seventh graders' test scores were up by 17% in the high and average categories for math, up 15% in those categories for reading, and up 12% in those categories for language arts. Eighth graders meeting competence were up 12% in reading and 7% in math. These results are promising but only a single case that needs confirmation from other school sites, and they only indirectly measure critical thinking.

Questionnaires show that the program's impact was felt by the majority of students in participating schools. Many reported that the critical thinking abilities they were developing helped them to study differently, to take tests more effectively, to note linkages among subject areas, and to understand what they were learning. Over half of the teacher teams noted that students were seriously engaged in learning, and became more reflective and better able to consider multiple perspectives.

Also significant was the program impact on the participants' views of themselves as teachers. They reported becoming more conscious of the need to make teaching more deliberate, to refine questioning techniques, and to infuse critical thinking within every class lesson. They explored new ways to assess student learning—trying to integrate students' processing skills with disciplinary content—using special essay questions, journals, lab reports, group projects, and simulations. Project

staff learned that they need not define critical thinking in exactly the same way in every school. The key to success, they claimed, was to define critical thinking within a predetermined cluster of abilities so that it has meaning for the faculty who will be teaching it.

Many reported greater enjoyment in teaching their classes, energized by heightened responsiveness of their students. Nearly all of the participating teams included all-faculty inservice as part of their plans, requiring teachers-in-training to give critical thinking presentations before their colleagues. In school after school, fellow teachers responded positively to the teams' presentations and to discussing learning and teaching issues with their colleagues.

Structural differences in the ways faculties worked together were reported. The work informally begun by teachers from different subject areas was continued in formally structured interdisciplinary exchanges among faculty in the schools. As a result of all these team activities, administrators of two districts incorporated explicit statements about critical thinking within their schools' educational goals.

In some schools, there was a strong tendency to simply equate doing and learning, without the necessary awareness of an individual learner's understanding. Participating teachers observed that for any systematic learning to take place, each critical thinking component had to be analyzed separately. That step of identifying and analyzing the abilities proved to be as difficult as teaching them.

What Activities Worked Unexpectedly?

While Alverno sought to improve its inservice, it did not anticipate the degree to which the teachers would be affected as professionals. Repeatedly, the teachers working together claimed not only to have enhanced school programs as embodied in the critical thinking plans but to have experienced renewed enthusiasm for teaching as well.

What Activities Didn't Work?

To a large degree, successful curricular reform depends on support from school administrators, especially in providing released time for participating teachers. In the first year, released time received low priority but was realized the second year through common preparation periods.

What Do You Have To Send Others And How Do They Get It?

Since the basic program strategy stressed individualized plans that matched the needs of each school, work products of the teams were not intended for other schools. However, teams could share their experience in addressing critical thinking goals in different school situations. Primary dissemination linked successful teams with schools of similar circumstances and populations. Alverno continues to make individual arrangements to work with schools that contact them, and either provide inservice or linkages with other schools.

Several project materials are available by writing to the project director. Alverno's final report provides a program overview, accompanied by videotapes of participants discussing the project and of inservices given by the teams.

Mary Diez
Alverno College
3401 S. 39th Street
Milwaukeee, WI 53215-4020
414-382-6213

What Has Happened To The Program Since The Grant Ended?

Alverno has maintained linkages with all 22 schools and several new ones, supplying useful resources, working on an ad hoc basis with their teams, and involving team members in critical thinking workshops or conference presentations.

The College's strong commitment to teacher education and its growing expertise in critical thinking has had a special impact on its own teacher education programs. First, it has provided Alverno with new colleagues in public and private schools and new sites for student teacher placements. Second, it has stimulated original classroom ideas to use with preservice education students. For example, an Alverno course now focuses on the development of critical thinking throughout the curriculum. Students design critical thinking plans and then compare them against those created by the team teachers to get a sense of how prepared the students are to work as school professionals.

Currently, the College is considering a master's degree program that would follow the design of the project, i.e., open only to teams of teachers from middle and high schools, and focused on curricular plans for developing students' abilities in critical thinking.

ATLANTA UNIVERSITY
Integrating Computerized Bibliographic Services Into Historically Black Schools

Purpose of Project:

Contemporary use of computer technology has revolutionized the concept of academic libraries from that of housing tangible physical artifacts to that of storing vast quantities of information in intangible electronic form. With the increased range of subjects now covered in research and educational data bases, computerized literature services for academic libraries have become almost obligatory today. This project proposed to supplement the limited library resources of historically black colleges and universities in two ways: by providing them access to computerized bibliographic information via a cost-effective network and by training librarians in the skills needed to deliver on-line information retrieval services.

Innovative Features:

The 15 participating institutions obtained computerized bibliographic services by subscribing to the DIALOG Information Retrieval System using a network format to link their libraries with this advanced system. These services permit accessing information that may or may not be physically located in a specific library.

The first phase of the project was devoted to training. Twenty-two librarians from participating institutions attended a one-month institute at Atlanta University devoted to referencing on-line information. They developed instructional modules that integrated computerized bibliographic resources into existing manual catalogue systems.

The second and third grant years were devoted to delivering reference services to the schools' academic constituencies, i.e., publicizing their availability and developing course-related modules for teaching on-line referencing within various disciplines. Once the services were known, librarians at participating schools searched a variety of data bases to fulfill information requests, and set in motion an evaluation of program costs and effectiveness. In addition to helping faculty and students in their bibliographic searches, information from the DIALOG network was used by administrators in program planning, budgeting and evaluation decisions.

Evaluation:

A 34-item questionnaire developed and administered by an external evaluator to assess the usefulness of the summer institute showed that the librarians felt professionally improved by learning state-of-the-art librarianship and that their bibliographic search skills were vastly upgraded. After returning to their home institutions, they employed what they learned about integrating computerized services into their manual systems, conducted library demonstrations, and assisted faculty with data base searches. Feedback from these faculty on the value of the instructional and research services was very favorable.

Assessments of the retrieval services at each institution were the responsibility of the participating schools. A few schools measured the quality of their new instructional modules by using pre-and post-tests of students' information retrieval skills; others used student evaluations of the modules developed by participating librarians. Both found students' interest and knowledge of library resources increased from exposure to the new instructional units.

The external program evaluator based formative cost evaluation on monthly statistical reports from participating libraries, including billings from DIALOG on data base use and connect hours.

Impact or Changes From Grant Activities:

Twenty-two librarians learned on-line bibliographic information retrieval skills to serve 15 historically black colleges and universities. Instructional modules in the humanities, social and natural sciences, and business were developed to teach students computerized referencing skills. Furthermore, all 15 libraries found ways to sustain the enhanced library services after FIPSE funding ended.

Due to financial constraints, the project could only allocate a total of 3,000 searches per year, or 200 for each of the 15 schools. Although an inadequate number for a combined college population of 43,000, it represented a significant improvement over previous on-line usage. For example, in 1984, a total of 53 searches were conducted for five of the participating colleges; with the advent of the project, 700 searches for these same five were undertaken in 1985, and as many as 900 in 1986.

Data on the number of searches conducted between 1985 and 1987 at the 15 participating schools show uneven use of the new library technology. Even so, the number of searches either increased the next year or remained the same.

The project gets credit for making the majority of searches possible.

For the first time, these 15 historically black schools could access information that was not physically located in their libraries. The training of their librarians in computerized bibliographic technology imparted state-of-the-art information retrieval skills. Both activities focused new attention on the library's central role in the academic advancement of the university and served, according to project participants, to enhance the educational mission and goals of these schools.

What Activities Didn't Work?

Administrators at the participating institutions used the search services less than anticipated. As a group, they initiated only 75 recorded searches over two years. However, the project's major shortcoming was the inadequate number of searches available to the colleges and universities chosen to participate. Nevertheless, the decision to introduce more black schools to these services than resources permitted resulted in integrating computerized retrieval within them all, and the institutional commitment on each of the 15 campuses to continue to support these services.

What Do You Have To Send Others And How Do They Get It?

Materials used by the instructors of the summer institute and the evaluation of the institute may be requested from the project director. Monthly reports from the participating libraries, which include statistics, teaching modules and other materials, are also available upon request. Finally, monthly billings from DIALOG citing the data bases used, connect hours, cost for each institution, and the cumulative costs may be requested from:

Lorene B. Brown
School of Library and Information Studies
Atlanta University
223 James P. Brawley Drive, S.W.
Atlanta, GA 30314
404-681-0251

Cost Efficiencies:

A subscription contract purchased from DIALOG through Atlanta University gave the schools access to the retrieval system at lower rates than could be purchased by their individual libraries. These cost efficiencies were crucial because of today's volume of publications and the costs of implementing new technologies. They were especially important for some of the black schools already operating at a deficit. Even those where computerized resources already existed, their costs dictate low usage.

Cost data show 1986–87 savings of $5,347 on library searches because of the subscription usage discount arranged with DIALOG. The monthly savings due to the network subscription amounts to about one-sixth of the total costs. Further savings were realized by centralizing billings of participating schools at Atlanta University, which also provided an accurate record for cost analysis.

What Has Happened To The Program Since The Grant Ended?

The participating libraries have received operational funds from their respective institutions to continue the new retrieval systems. All 15 historically black schools now have, in use, systematic strategies for locating, identifying, and evaluating information resources.

UNIVERSITY OF CALIFORNIA—LOS ANGELES
A Value-Added Approach to Institutional Excellence

Purpose of Project:

UCLA employed a value-added method to achieve institutional excellence—one that differed significantly from traditional approaches based on tested abilities of entering students. In this project, effectiveness was judged by an institution's capacity to develop the talents of students. The focus was on how much students actually learned or improved from entry to exit rather than on their relative level of competency at the point of entry.

Its primary purpose was to assess student liberal education outcomes as a way of strengthening institutional effectiveness. Under this view, a high-quality institution develops and maximizes the intelligence and personal talents of its students. The student assessment programs were implemented by a consortium of seven colleges and universities (Spelman College, Eckert College, UCLA, Carnegie Mellon University, Empire State College, Hood College, and Rhode Island College).

Innovative Features:

Beginning in 1984, these seven diverse institutions worked together to create a model value-added assessment program. This was the first time such a program was attempted by a consortium. The deliberate mix of institutions permitted testing the generality of findings in a variety of educational contexts.

Evaluation:

To obtain baseline data on student attitudes and expectations, institutions administered the Cooperative Institutional Research Program's freshman survey in 1984. Baseline data on general education were gathered by administering a common instrument, the ACT-COMP battery. The evaluation design also included post-test assessments: affective information from the Follow Up Survey of entering students and cognitive data from a readministration of the ACT-COMP. Testing students on the same or similar instruments at repeated intervals provided measures of growth or changes over time—the value-added.

All member institutions are now developing a longitudinal student data base that will become a regular part of the institution's planning and management. Evaluation data will

go beyond standardized test results and include information on residence life, study habits, extracurricular activities, and choice of major.

Thus far, the project has been evaluated through comprehensive case studies and site visits to each campus by the Higher Education Research Institute (HERI) staff as well as through regular meetings of the consortium participants.

Complex consortial projects involving a number of institutions, such as this one, require more than several years for full implementation and adequate evaluation. An impact study measuring student outcomes got under way in the fall of 1989. Longitudinal student data from the seven participating consortium institutions will be compared with data from a matched control group of seven non-participating institutions on such outcomes as student retention rates, changes in student satisfaction with their institutions, and changes in students' educational plans and vocational aspirations over time.

Impact or Changes From Grant Activities:

The project has already changed thinking significantly about the role of assessment and its relationship to effective institutional practice. Not only do participants demonstrate an informed awareness of assessment, in general, but they have committed their institutions to long-term value-added assessment, in particular. Evidence ranges from successful efforts of campus leadership to commit needed staff resources, to the creation and funding of full-time assessment positions, to the implementation by several consortium institutions of regular longitudinal assessment programs, to plans to continue and enlarge the consortium.

An unanticipated institutional need for assistance in establishing longitudinal student data bases was answered by project-sponsored value-added workshops and a specially created two-hour videotape that explores relevant technical and organizational data base issues.

What Activities Worked Unexpectedly?

Unexpectedly, the consortium structure turned out to be a major element of the program's success. Its cooperative dynamics helped keep the participants on track because they were able to exchange information, identify common problems, and profit from each other's solutions.

Probably the most critical finding of the project thus far is the need for comprehensive student data bases drawn from data in

admissions, financial aid, student affairs, placement, alumni, registration, student academic and entry characteristics. These data provide a context for the students' college years—their courses, programs, and activities—within which to make sense of the assessment data. In fact, the absence of such data bases is the single biggest impediment to effective use of value-added assessments.

What Activities Didn't Work?

Initially, the project assumed that participants would be able to link their value-added assessments to other critical student data. This turned out to be a naive assumption; there were really no longitudinal student data bases to permit these linkages, so new assessments were conducted largely in a vacuum.

The other problem for the project was finding suitable instruments for assessing general education. The ACT-COMP presented difficulties with test administration and interpretation of scores. Therefore, some consortium members have decided to build on existing cognitive assessments and use admissions or subject placement tests as "pre-tests" repeated at appropriate intervals to create value-added longitudinal data.

Similarly, outcome assessments such as comprehensive examinations, competency tests required for graduation, junior exams, professional certification exams, or graduate school admissions tests may be used as pre-tests at some appropriate earlier time to produce longitudinal data. Some consortium members came to feel that to ensure accurate and adequate pre-testing and post-testing, participation in assessment on campuses should be required.

What Do You Have To Send Others And How Do They Get It?

A major outcomes monograph entitled *College Student Outcomes Assessment: A Talent Development Perspective* has been published by ASHE-ERIC. Its unique feature is a detailed compendium of available instruments for assessing cognitive outcomes. Also the HERI staff prepared a newsletter, the *Value-Added Exchange*, for consortium members and other interested parties about program developments.

Also available is a two-hour videotape on how to design and conceptualize a comprehensive student data base, the technical and political considerations in creating it, and how the data can be used for institutional self-study and analysis. Interested readers can obtain a VHS cassette copy of this video for $25 by writing to:

Alexander W. Astin
Higher Education Research Institute
Graduate School of Education
UCLA
Los Angeles, CA 90024
213-825-1925

What Has Happened To The Program Since The Grant Ended?

Current planning involves enlarging the consortium to perhaps 35 institutions that will implement findings from the study. Potential participants are gathering and the project is looking for funds to support this expansion. Beyond this financial and organizational base, members are hoping to employ a full-time consortium director and develop regional workshops on value-added assessment themes. The project has inspired a publication through the ACE McMillan Series in Higher Education entitled *Assessment for Excellence: Philosophy and Practice of Assessment in Higher Education* and has influenced California legislation on talent development by endorsing comprehensive data bases on all campuses in the state.

Project Insights: Key insights from the case study visits include:

- Faculty resistance is a normal part of the process of instituting an assessment program. Given proper consideration to faculty criticism and debate, projects can use it constructively to translate opposition into advocacy.

- Using the ACT-COMP long form to assess general education has its problems, especially in its administration and the interpretation and meaning of scores.

- A considerable amount of advance planning allows involving faculty, staff, and students in the assessment process. Some of the consortium members advocate making participation in assessment an institutional requirement.

- As noted earlier, value-added assessment can build upon existing assessments, particularly admissions and subject matter tests. Longitudinal insights about student development can be gained through repeated administration of these tests over time. Also assessment efforts seem to clearly benefit from being anchored in existing routines, as in using orientation and registration opportunities for pre-test data collection.

- Assessment projects especially benefit from having key administrators personally involved, and rewarding and encouraging faculty participation.

- A longitudinal student data base is key to an effective value-added assessment program.

CARNEGIE MELLON UNIVERSITY
A Learner-Centered Computer Environment for Critical Reading, Reasoning, and Writing

Purpose of Project:

As part of the recent surge of interest in studying writing and computing, researchers at Carnegie Mellon University (CMU) developed a cognitive model of the composing process. The WARRANT project emerged as one response to poor composition; even at "better " institutions, students do not write argumentative essays well. Its staff exploited the novel cognitive research being conducted at CMU by developing a computer-based curriculum on the processes of structuring argumentative writing.

Innovative Features:

The project assumed that skills of reading, writing, and reasoning are highly interdependent—that students' inability to write well goes beyond writing to their inability to read and reason critically. To address this problem, CMU observed, close-hand, experienced and inexperienced writers at work, employing what they called "process-tracing" methods such as thinking-aloud or interview protocols. These observations led to improvements in the traditional way of teaching students to read and write argumentation.

The new reading/writing curriculum now in use was designed to help students read critically, reason about what they are reading, and write original essays. It focuses upon key processes revealed in the data analysis.

- *Summarizing*. Students learn to reconstruct an author's line of argument and to produce a written summary of an author's position.
- *Synthesizing*. Students learn to design structures that allow them to compare the lines of argument of multiple authors. They learn to write a synthesis essay.
- *Analyzing*. Students learn to reach their own conclusions on an issue by exploring and evaluating possible positions. They learn to write an analysis of an issue.
- *Contributing*. Students learn to construct an original line of argument from their conclusions and to write an original essay that makes a contribution to an issue.

Evaluation:

Formative evaluation took the form of observing students on computer tutorials being tested for teaching reading and writing, run on the Andrew computing system. Thinking-aloud protocols were gathered from both novice and expert writers. Participants read two short essays on an issue, wrote an essay that synthesized them, and laid out their own positions. Or they read a group of authors who addressed a single issue and then tried to say something original about it. While writing, they were asked to think aloud and take notes as they wrote and what they said was recorded.

Analysis of students' cognitive processes and thinking-aloud notes were used to revise the tutorials, as were interviews with the students about their reading and writing tasks. The tutorials have menu options that allow users to report problems and reactions, as do CMU's campus-wide electronic bulletin boards, so both suggested needed revisions. Other kinds of ease-of-use information, questionnaire, and observation data are still being analyzed.

Impact or Changes From Grant Activities:

The project designed two computer tools to aid writers engaged in reading and writing processes. Essentially, *Notes*, a hypertext tool, was designed to help students take notes while reading. It allows the user to record his own ideas while reading, recover the context for those ideas easily, and view ideas from multiple perspectives.

Comments enables teachers and students to respond to each other's texts by "talking" about them over a campuswide network of workstations. They can discuss their work progress, ask for clarification, and share plans for revision. This program serves as a communication support system for writers and readers. Both tools, *Notes* and *Comments*, are now used in CMU's new writing curriculum on strategies for writing, reading texts, and reading and writing arguments.

Arguing From Sources: Exploring Issues Through Reading and Writing (Harcourt, Brace and Jovanovich, 1989), embodies a course based on project research "to solve problems in teaching original argument from sources, more commonly known as the research or term paper."

Students working with the *Comments* program succeeded in correcting more grammatical errors than students working with a traditional hard copy handbook. Interview data from student and teacher users showed that the *Comments* program had altered their patterns of interactions about writing, especially

in the frequency with which teachers encourage students to submit drafts and the frequency with which students submit drafts or multiple drafts for comment. Currently, CMU is studying the effects of patterns of increased teacher-student interaction via computers with quality of writing.

The *Notes* program reduced students' difficulties in writing from source texts by automating lists of these texts and linking students' notes to them. The program allows users to compose notes, display them for viewing, create alternative lists of notes, cut and paste across different lists, and group notes into appropriate categories.

Typically, inexperienced writers spend much of their time writing down quotes from source texts rather than recording paraphrases, inferences, and interpretations. Indeed, program data showed that *Notes* freed students to take significantly more reflective notes and to record their own ideas.

Students' attitudes were slightly positive on all nine dimensions tested for the *Notes* program, except its speed. For the Comments program, students were neutral to slightly positive on seven dimensions, but were slightly negative about the program's speed and familiarity.

What Activities Didn't Work?

Although CMU has one of the highest access ratios of students to computers in the country, the demand for workstations continues to exceed supply. Until access to the technology improves, it is unlikely students will use the computer tools outside course requirements. Advanced function workstation technology is essential for supporting extended reading and writing tasks. Since the price for high-function workstations continues to drop, CMU will recommend that students buy such machines.

Besides access, a continuing problem that plagues educational computing at CMU and elsewhere remains hardware/software incompatibility. Because the program's textbook, *Arguing From Sources*, is printed on paper, everyone in the country will have access. Because of hardware and software incompatibility, the same cannot be said of the computer tools.

These tools run on Andrew, a system designed to maximize portability to different hardware. As a result, they run on IBM-RT-PCs, SUN 2s and 3s, and DEC VAX-stations. Its designers remain committed to the idea that educational software should be as portable as books—an idea that seems a long way off as CMU faces another influx of incompatible hardware and software.

What Do You Have To Send Others And How Do They Get It?

The program produced a textbook based on the four standard writing tasks central to the WARRANT project: summarizing, synthesizing, analyzing, and contributing. The book, *Arguing From Sources: Exploring Issues Through Reading and Writing*, D.S. Kaufer, C. Geisler, and C.M. Neuwirth (Harcourt, Brace and Jovanovich, 1989), is described by its authors as "one of the fruits of the project, with goals of conducting research, building a curriculum, and designing a computer system to support the reading and writing of issue-centered argument."

Another book, *Reading and Writing with Andrew: An Instructor's Guide*, is intended for faculty not directly involved with this project. It was distributed to all English faculty and graduate teaching fellows in the fall 1988 semester. The book provides teachers with a guide to using the software and other Andrew facilities for teaching reading and writing. The computer programs have received some outside distribution. For example, the University of California at Berkeley recently used *Notes* in a writing course for junior and senior engineers for several terms.

Those who would like to obtain the *Notes* or *Comments* programs should contact:

ICEC-WARE
CDEC Offices, Bldg. "B"
Carnegie Mellon University
Pittsburgh, PA 15213

Technical reports about the program, such as *An Instructor's Guide* mentioned above, are available from:

Christine M. Neuwirth
Center for Educational Computing in English
CC Technical Reports
Department of English
Carnegie Mellon University
Pittsburgh, PA 15213
412-268-8702

What Has Happened To The Program Since The Grant Ended?

CMU maintains the view that computer-based tools hold the potential to achieve revolutionary improvements for students learning to read and write and for their teachers. It continues to support the staff of the Center for Educational Computing in English required to maintain and enhance the software tools, to train new users and to answer users' questions. In addition, this staff provides support to schools that are Center members

(and other schools for a small service fee) that wish to use the tools at their campuses.

The course associated with the project, 76–122 Reading and Writing Arguments, continues to be taught, usually with three sections. Now that the textbook is published, the course will become part of the core language, culture and history breadth requirement for all English majors.

The project has spin-off initiatives under way, especially in designing a second version of *Comments*, and has received support for this purpose from the National Science Foundation and from a local private foundation.

DEPAUL UNIVERSITY
Equal Educational Opportunity for Learning Disabled College Students

Purpose of Project:

This project sought to become a model program of support services for learning disabled (LD) college students. It is an optimistic response to the growing recognition that many students with learning disabilities can benefit from a college education, given appropriate support. Ultimately, the aim is to increase college access and reduce attrition for LD students.

Innovative Features:

DePaul's program built upon a FIPSE project at Central Washington University, expanded its range of student services to include academic instruction, advocacy, accommodations, personal and academic counseling, and diagnostic testing. Very few current programs are so comprehensive in scope. For example, the academic instruction services include one-to-one instruction with an LD specialist and specific course tutoring. Accommodations include test proctors, notetakers, and tape recorders in class. Students are free to select only those services they feel they need, but most opt for one-to-one learning sessions two hours a week.

The program calls itself Project Learning Strategies (PLuS) to reflect its unique approach not only to tutoring students in specific subject matters but also to helping them understand their own learning patterns and adopt individualized ways of studying. PLuS also assists University faculty gain a broader perspective about the problems LD students face.

Different issues are confronted by those students applying to college and already identified as LD, and those students who have already gained access to college but have not yet been identified as LD. For the first group the main issue is admissions; for the second group the main issue is testing to identify the disabilities.

Evaluation:

A tracking system links student entry characteristics with academic performance data so that progress can be documented systematically and needs can be served promptly. Using this system, academic performance of LD students is measured by tracking both grades and enrollment behavior, i.e., persistence of enrollment and credit hours per semester. The level of student success—academic performance and persistence—implies the level of program success. An annual

survey studies student satisfaction with the quality and adequacy of support services.

Entry interviews gather information about educational and career goals, expectations of the support program, and students' self-assessments. Prior to graduation, these interviews are repeated to identify changes attributable to the program. Graduates are followed up a year later to chart any enduring changes.

Impact or Changes From Grant Activities:

Now into its fifth year, the program has served 96 students. It claims ten graduates with several employed, two in law school, two in MBA programs, and one working on a Ph.D. Other students expect to graduate this year. This is a promising early record considering that at least 50% of the students are on academic probation (or "at risk") when they enter.

The grade point averages of program students have held steady over the years. Their GPA for 1988–89 was 2.8, ranging from 1.61 to 3.83. Only three students have been dismissed, and a few have been lost through transfers or financial problems. Thus far, the program has an attrition rate considerably lower than the 37.8% drop-out/transfer rate for De Paul as a whole.

Students report they are satisfied with 92% of the program services, especially the one-to-one tutorials, academic and personal counseling, and small group instruction. The one-to-one sessions with an LD specialist and academic counseling are the most used services, followed by accommodations and advocacy, and specific course tutoring.

These findings reinforce the notion that, with only a few hours a week of supportive services, LD students can survive in college; they refute the idea that learning disabilities are synonymous with lack of intelligence or lack of high school preparation.

As an offshoot of the program, DePaul has launched a national survey to compare their program model to others serving the learning disabled, and they plan to disseminate useful ideas and solutions. Because of the variety of assumptions about the population, the project director cautions those staffing similar programs to consider carefully the backgrounds, knowledge, and philosophies of those chosen to serve it. Crucial too are early structural decisions about where the program is to be housed, to whom the program will report, and what other

University resources may be tapped. Comprehensive programs are usually found in schools of education where a variety of support services already exist.

What Activities Worked Unexpectedly?

Overall, the program progressed very much as planned. However, the project staff was astonished by the number of students referred to them who were already enrolled in the University. These students were struggling to survive in college, never suspecting that they were doing it with learning disabilities.

What Activities Didn't Work?

During the three years of the grant, the program served fewer undergraduate LD students than originally projected, although current enrollment is growing sharply. The program was also unable to accommodate the participation of graduate students as tutors. Furthermore, group instruction in spelling and reading comprehension was discontinued. Students' needs were so diverse that they were not able to make good use of group instruction.

In organizing a parent support group, staff misjudged interests of their older program students, and the group was never formed. Generally, the more personal services, such as the student discussion group and personal counseling, were the least used, perhaps for age reasons as well. However, the discussion group was restructured for the 1988–89 school year. By making attendance mandatory for incoming students in the first quarter, the group has become a viable resource for LD students struggling with being in college.

What Do You Have To Send Others And How Do They Get It?

Two booklets listed below, one to help college faculty understand learning disabilities and another to help LD high school students prepare for college, were produced and are available at minimal cost. Because project staff and FIPSE want these booklets to reach as many people as possible, those wishing to duplicate them may do so in unlimited quantities free of charge, as long as certain requirements are met. Please write for a copy agreement so that De Paul can keep track of distribution:

Carol T. Wren or Alisa Padzensky
DePaul University
2323 N. Seminary, #220
Chicago, IL 60614
312-341-8100

College Students with Learning Disabilities: A Student's Perspective (20 pp. Contrasts a student's narrative with professional interpretation and background information. Both

the student and service provider describe the path from pre-diagnosis to accepting and understanding the LD diagnosis. Suitable for college faculty, staff, and students.)

College and the High School Student with Learning Disabilities: The Student's Perspective (36 pp. Depicts two LD students' experiences in high school, their successes and failures, and their encounters with college life. Suitable for high school students, parents, teachers and counselors.)

An article drawn from program work with LD students, "Studies in Diversity: Strategies for Students with Organization Problems," appears in *Academic Therapy*, 1987, Volume 23, Number 2, pp. 157-165.

Cost Efficiencies:

Many of the key structures and services used in the program were already in place within the University, so it was not necessary to create a new office. Costs were minimized by using existing resources and by working closely with programs whose resources were previously underused, e.g., the Department of Support Services, the Mental Health Service, the Writing Lab, the School of Education's Reading and Learning Disabilities Program, and the Center for Reading and Learning. Tuition dollars of currently enrolled LD students who would otherwise have dropped out, and new tuition dollars of LD students coming to De Paul expressly for the program, also helped to offset costs.

What Has Happened To The Program Since The Grant Ended?

After FIPSE funding ceased, the project continued essentially as designed, fully supported by the School of Education, but with a new project director. Continuing goals are to serve more learning disabled students each year, secure full-time staff, and expand distribution of program materials even further.

One of the program's booklets, *College Students with Learning Disabilities*, has been sent to more than 285 colleges and universities (11,000 copies), 135 other school and parent organizations (1,200 copies), and 100 individuals (175 copies). Thus, 12,375 copies have been sold or reproduced; 8,455 copies of the other booklet entitled *College and the High School Student with Learning Disabilities* have been distributed to high schools and relevant consultants at State Boards of Education in each state. Another 1,000 were sent to every local chapter of the Association of Citizens With Learning Disability. Together, then, more than 20,000 booklets have been distributed.

DEPAUL UNIVERSITY/School for New Learning
Master of Arts Program for Practicing Professionals

Purpose of Project:

The project was to design, plan, and implement a Master of Arts Program for Practicing Professionals. It focused upon both liberal learning and professional competencies, teaching students how to link them in the workplace. These professional competencies included knowing primary theories in the field to be able to conduct research within it; having strong verbal communication skills; and viewing issues within a temporal, cultural and international perspective and with ethical sensitivity.

Among others, liberal learning skills included the ability to frame and solve problems and the capacity to make decisions informed by values. These are prerequisite skills to strong performance in any field, among them business, social service, law and government, health care, media and arts—all fields that these DePaul students seek.

Innovative Features:

This new graduate program focuses exclusively on student learning outcomes, using assessment review committees and criteria that define acceptable levels of performance for awarding degrees: knowledge and abilities in professional concentrations and in liberal learning.

To enroll, students must have a minimum of three years' prior work experience in the professional area they plan to study. Students' workplaces are used as learning sites for how practice and theory may meld. Students produce individualized learning plans for their fields of concentration, with the help of professional advisers and academic mentors, in such fields as media marketing, small business management, governmental relations, publishing communications, health economics, and community law.

These learning plans may include analyses of their own or other workplaces or independent research, and they may earn credit for demonstrated prior learning. All students must complete a common curriculum, a series of seven 4–5 week colloquia focused on liberal learning themes and their workplace applications. They culminate the program by producing a Master Work, an in-depth essay integrating practice and theory, liberal learning skills and professional work, in their areas of concentration. Sample titles from the research of completed Master Works include: "Design of a

Model Energy Management System for the Automotive Industry," "Career Management for the Director of Volunteer Services in Health Care," "The Role of the Subject Matter Expert in the Capital Recovery of the Telecommunications Industry," "Development of a Strategic Plan for a Non-Profit Organization," and "Design and Implementation of a Computerized Automotive Accounting System."

Students from diverse professional concentrations learn together in small groups called clusters. An assessment contract is used to plan, monitor, and evaluate learning outcomes. At five critical points in the two-year program a review committee assesses each student's work. This assessment is preceded by extensive student self-analysis, for which program participants are specifically trained.

Evaluation:

The School engaged Formative Evaluation Research Associates (FERA) to undertake continuous program evaluation using interviews, questionnaires, site visits, and case studies on 10 selected students and three clusters. Interviews with professional advisers and academic mentors were designed to confirm or disconfirm students' evaluations of their own performance and program effectiveness. The academic work of the students was also evaluated by committees of faculty and outside experts in the respective fields.

The process evaluation used by FERA enabled the program staff to learn from the experiences of the three clusters in the pilot phase and to adapt the program to these experiences. The program model, as revised at the conclusion of the pilot phase, formed the framework for an additional nine clusters yet to undergo evaluation.

Impact or Changes From Grant Activities:

The enrollment of the newly established program within the School for New Learning has grown to 91 graduate students, out of 142 applicants admitted. (25% of these students come from DePaul's undergraduate body.) Already the program's students are reaping benefits from participation: all 10 students subjected to case studies received promotions or other job-related rewards while enrolled in the program. A one-year follow up on the first wave of 20 program graduates showed that 75% benefited after graduation as well in promotions, increased work responsibilites, and in managing successful business ventures.

Evaluations of individual students who have graduated document their intellectual growth and skill development, both in self-reports and faculty assessments of their program work and liberal learning skills. When students' own ratings of their

mastery of liberal learning skills are compared against ratings by their mentors and advisers, the means are remarkably similar and high for 7 of 10 students studied. This pattern continues today. As student ratings improve from early to later clusters, the interrater reliability increases, implying greater stability in program standards. FERA concluded from such data that the program fosters learning and satisfies standards for credentialing.

All academic components of the program on FERA's evaluation survey were rated favorably by students, especially the individualized fields of concentrations, the common curriculum, the Master Work, and the professional advisers. Generally, evaluations of the program's effectiveness improved as the program matured and adapted to each new cohort of admitted students. For example, significant improvement (from a mean of 3.0 in cluster 1 to a mean of 4.5 in cluster 3) was achieved in students' understanding of integrating liberal learning into the workplace.

What Activities Worked Unexpectedly?

Perhaps the most significant unexpected benefit of the program was the power of group learning which brought students from diverse professional backgrounds together in weekly learning groups. Students felt that combining expertise within the colloquia as they investigated common problems enhanced learning and work performance.

What Activities Didn't Work?

Initially, the program assumed that the common curriculum would contain colloquia on cross-disciplinary topics. In this way, students would be able to transfer skills and perspectives of liberal learning to their professional settings. This transfer did not occur. Thus the colloquium series was reconceived to clarify the connection between liberal learning components and workplace activities.

FERA was concerned that program students took longer than the expected 18–24 months to graduate. Inefficiencies in the startup phase explained part of the problem; several changes now have been instituted to encourage students' progress, i.e., requiring completion of at least one assessment contract per quarter and intervening with students who are not making adequate progress toward degree goals.

As it turns out, graduate rates in later clusters indicate that 18–24 months is a realistic time frame. Many students, however, elect to take longer, either to accommodate heavy job responsibilities or to engage in non-school projects. As students elect to take longer than two years, advising, staff, and other resources may need extending.

What Do You Have To Send Others And How Do They Get It?

Materials available to others include a 50-page final report to FIPSE describing the steps necessary for establishing and implementing the program, including course syllabi and evaluation results. Beyond the final report, materials about various program components, such as the Liberal Learning Assessment Colloquia and the Professional Assessment Weekend, are available. Please request materials from:

David O. Justice, Dean, or Catherine Marienau, Director
School for New Learning
DePaul University
243 S. Wabash, 7th floor
Chicago, IL 60604
312-341-6733

Cost Efficiencies:

Costs are contained by extensive use of professional advisers paid token honoraria. The advising component is built into the curriculum, so that faculty are responsible for student orientation, advising, and program development. The bulk of teaching in the common curriculum is done by adjunct faculty, who are paid on a contract basis.

Because advising and assessment in the professional concentration rests heavily with professional experts from the larger community, substantial resources are required for adequate orientation, training, and monitoring of their responsibilities.

What Has Happened To The Program Since The Grant Ended?

The program is an ongoing and self-sustaining graduate degree offering at DePaul University. It has grown from 3 to 14 learning clusters, the last 2 added in late 1989. Current plans are to offer the program on-site to selected major corporations and non-profit organizations in the Chicago area. Through the Council for Adult and Experiential Learning, corporate representatives have been informed about the program for working professionals, and discussions have been held with several companies.

The program's continuing aim is to help prepare a competent and adaptable workforce. Project staff have been publicizing the program by presenting workshops and papers in the United States and England, and are experimenting with ways to adapt the model to different clienteles.

Project Insights:

A few key insights coming out of the new Master of Arts Program include:

- Work experience at responsible levels of decisionmaking is an important prerequisite to success

in this type of program. Students need a rich base of experience and knowledge about their prospective field in order to fashion a sound, individualized program of study.

- The melding of liberal learning and professional competence does not happen merely through exposure to appropriate subject matter; liberal learning skills need to be purposely built into the curriculum and reinforced by repeated student and faculty assessments.

- The academic mentors, professional advisers, and students continually struggle with how to apply professional and academic standards to judgments about the quality of workplace learning. More research is needed on the link between standards and performance in professional education.

GEORGETOWN UNIVERSITY
Interdisciplinary Education for Advanced Technology and International Public Policy

Purpose of Project:

Most educators would agree that informed public policy must be able to anticipate and respond to new technological advances. And future policy makers need to be sufficiently literate in science to grasp and discuss key scientific issues with technically trained personnel. The Georgetown project tried to integrate the study of advanced technology into interdisciplinary programs by informing students of international affairs and public policy about computers, robotics, telecommunications, aerospace and biotechnology. Specifically, the program staff designed new courses and modules for existing courses, as well as a series of public lectures, to inform non-specialists about advanced technology.

Innovative Features:

Innovation lay in the yoking of subject matters. In "Fundamentals of Advanced Technology," nuclear power, aerospace technology, biotechnology, telecommunications, and computer technology were examined for their impact on military policy, economic competition and trade negotiations. "Advanced Technology and International Business" focused on major policy issues facing government and international business in the application of advanced technologies.

Topics included such matters as pricing policy, research and development, intellectual property rights and transborder data flows, all considered in light of advances in electronics, telecommunications, aerospace technology and biotechnology. Lecture series titles included "Computers and International Relations," "Technological Change and Multilateral Trade Controls," and "Making Space Pay: International Cooperation and Competition."

Georgetown decided the time had come to teach the application of science as a subject matter in its own right, so that its students would gain a base knowledge in technology and suffer less technophobia. Project staff learned that the key to teaching advanced technology to social science students was to combine core science knowledge with ways different technologies actually worked, and then use timely examples of contemporary technology. Teaching technology would give students an applied science primer—a common preparation for their other program courses. Basic University science requirements determined the appropriate teaching level for these non-science students.

Evaluation:

The project was evaluated during its planning and implementation stages by an internal academic committee and a board of advisers to the Landegger Program in International Business Diplomacy. The internal committee subjected the courses to rigorous academic review in the developmental stage and later oversaw the integration of project results into ongoing curriculum.

Student evaluations and debriefings of selected students were employed to help evaluate new courses, course modules, and classroom materials, all of which received very favorable ratings. Attendance and subsequent involvement in project activities were used as measures of success for the public lecture series, as were institutional commitments to continue offering newly developed courses and modules.

Impact or Changes From Grant Activities:

The most solid evidence for change due to the project rests in the two new courses that grew out of the interdisciplinary initiative. In addition, several course modules and new interdisciplinary classroom materials on advanced technology were developed and used in courses on business diplomacy and business ethics.

The courses are offered each year as part of a new field of study, bringing new faculty resources and expanded class choices in technology to both undergraduate and graduate students. They have been approved for incorporation into the Foreign Service School's curriculum, and follow-up courses are envisioned for particular fields of advanced technology. In the words of the physicist who taught these courses, "Our social science students consistently outstripped the institution's expectations of them for learning technology."

Administrators were able to expand curricular offerings and open a new field of study through new courses, course modules, team-teaching, and course cross-listings. Grant activities gave faculty the time, resources, and scheduling flexibility to cross academic disciplines, while bringing in new adjunct faculty and identifying expert guest lecturers from the local community.

Institutional policies and procedures were not changed substantially by grant activities. However, procedural flexibility, particularly in the Foreign Service School and the Landegger Program, permitted an interdisciplinary cooperation needed for linking the fields of technology and international public policy, and for generating resources external to the University.

Social science students gained technical grounding in key advanced technologies in specially designed courses. For example, "Fundamentals of Advanced Technology" was sufficiently successful to warrant a core course in a new undergraduate major entitled *Science, Technology and International Affairs*. Other new and modified courses will form the basis of a business-related concentration within this new field of study.

What Activities Worked Unexpectedly?

The development of a collection of readings for the "Fundamentals of Advanced Technology" course provides a key resource aid for interdisciplinary teaching. The evolution of this material into a textbook is ongoing but originally unanticipated. Two class field trips to INTELSAT and the National Bureau of Standards' Robotics Center proved to be valuable features of one of the technology courses, despite some initial doubts during course planning.

What Activities Didn't Work?

Both the opportunities for and the practical difficulties of curricular innovations that rely on a combination of internal and external resources led to various project lessons. These difficulties should not be underestimated. A team-teaching approach in the first "Fundamentals of Advanced Technology" course worked well to provide teaching expertise across disciplines. However, since two or three on the team were adjunct faculty, it did not work well in providing course coherence or student access to teachers. Since the first offering, the course has been taught by a single faculty member.

Course materials proved to be even more of a problem than expected. Because there were no textbooks for this interdisciplinary area—which is characterized by rapid change—readings had to be drawn from a wide array of sources. Materials that met standards of timeliness, length and general readability were difficult to locate. Disparity in reading materials led to the unanticipated task of developing an integrated set of readings and teaching notes to improve class coherence.

What Do You Have To Send Others And How Do They Get It?

The project's final report to FIPSE and course syllabi are available from the project director:

Theodore H. Moran, Director
Karl F. Landegger Program in International Business Diplomacy
School of Foreign Service
Georgetown University
Washington, DC 20057
202-687-5854

These syllabi provide a unique resource base of reading materials not often assembled, combining international affairs and advanced technology. Materials have already been distributed through the Association of Professional Schools of International Affairs, and to other interested institutions.

Cost Efficiencies:

Cost efficiencies were achieved by close coordination of activities both within the administering Landegger Program and between the program and the Foreign Service School. A parallel project in international business diplomacy was designed with an advanced technology component, thus making the project's curricular products more widely useful.

Project coordination with the Foreign Service School led to an adjustment of the new courses so that they would fit within a new major field of study, thereby expanding the student population served by those courses. Finally, the project drew on business and community practitioners to supplement University expertise.

What Has Happened To The Program Since The Grant Ended?

The courses and modules created or modified by this project have been integrated into the ongoing curriculum of the Foreign Service School, and are offered each year or each semester. They are supported in part by the School and in part by corporate contributions to the Landegger Program. Follow-up courses in particular technological areas are being explored to supplement the business offerings in the new field of *Science, Technology and International Affairs.*

LONG ISLAND UNIVERSITY
The Hellman Academy for Mathematics and Science Teacher Education Retraining (THA-MASTER)

Purpose of Project:

THA-MASTER is a model program for training experienced teachers from other disciplines as secondary school teachers of mathematics and physics. It is offered as a way of relieving the nationwide teacher shortage in these critical areas through recruitment and retraining, while simultaneously providing new career opportunities for faculty.

Innovative Features:

The curriculum for these teachers assumes little or no prior knowledge of math and physics. It reflects program philosophy that distinguishes between the preparation of a future teacher and the preparation of a future researcher. The retraining approximates the formal study of a traditional mathematics or physics major, using a series of graduate and refresher courses and workshops, and satisfies requirements for state certification and city licensure. Successful completion of the refresher courses is one of the entrance requirements.

Retraining programs, such as THA-MASTER, that develop expertise from other disciplines, have emerged as an innovative strategy for dealing with the teacher crisis. The relative ease of adapting this model to new settings and its success in producing competent science and math teachers has led one state to adapt the curriculum as its alternative certification. The pool of experienced teachers turned out to be a prime recruitment source of teachers in mathematics and science. The additional certified math and science teachers provided to the participants' home states attest to the program's impact.

Both NSF and FIPSE provided funds for retraining teachers and for testing the models at different sites. The program plan brought together representatives from the University, the State Education Department, the City Board of Education, and postsecondary mathematics educators. Long Island University, the home site, was originally funded to include three additional dissemination sites. When the field response greatly exceeded expectations, the number of sites was expanded to seven. Long Island University's project director functioned as liaison to each.

Evaluation:

Data were gathered from a variety of sources: pre- and post-tests of subject content and teacher attitudes; interviews with

project staff, faculty, students, and sites directors; course evaluations; classroom observation visits; and monitoring of project activities.

Impact or Changes From Grant Activities:

At the home site of Long Island University, approximately 70% of the initial and later groups of teachers secured mathematics licenses from the New York City Board of Education, an indication that the program was successfully retraining certifiable teachers. Over the course of the program, more than 200 students graduated and, of those, over 50% became certified and are now teaching mathematics or physics in their states. As a yearly average, 24% of those retrained teachers were minorities.

A 30-item math content test administered to one set of students before and after their course yielded highly significant results. (See Table 1.) According to a member of the New York Board of Examiners, THA-MASTER students performed well when compared with regularly trained mathematics teachers, and substantially better than those certified without benefit of the program. Beyond this, math examiners note there is no discernible difference between the program graduates and traditional math majors on written examinations.

Table 1

Student Performance on Mathematics Content Test (N-16)

	Pre-test	Post-test
Mean	8.8	23.7
Median	.8	23.0

At all the sites, teachers completed programs of preparation for certification. Trenton State College's math retraining program attracted 36 teachers; of these, 22 completed the program and have or will receive certification. As a parallel development, the College's curriculum to retrain teachers in mathematics was evaluated against the seven standards set by the National Association of State Departments of Teacher Education and Certification. Those stringent standards require demonstrated competence in knowledge and understanding of the basic concepts of algebra, geometry, analytic geometry and calculus, probability, statistics, and modern algebra; in mathematical vocabulary and symbols; in number concepts and computational algorithms; in the intellectual and philosophical natures of mathematics and methods; in the application of models to applied problems; in solving problems involving the

application of math concepts and principles; and in using calculators and computers in math applications and computer language for writing programs. All seven standards as applied to Trenton's program were found to be fully met.

At Arizona State University, the program began with 32 participants and ended with 19. Comparisons between pre-test and post-test scores on mathematics content tests showed a marked increase in their level of performance, significant at the 0.01 level. All but three of these students are now working as full-time mathematics teachers in the Arizona school system. Districts will be asked to make the following comparisons to uncover any performance improvements:

- Between students of those teachers who participated in the program and students of these same teachers in pre-program years;
- Between students of those teachers and past students in the entire district; and
- Between students of those teachers and students in the entire district in the same year.

At Beaver College, 13 of 17 teachers completed the program; of those, seven have taken positions teaching mathematics. Pre- and post-content tests of program participants showed measurable increases in mathematical knowledge. As a result of participation in THA-MASTER, the College has received $300,000 in grants from the state and the school district of Philadelphia to work on upgrading the training of certified teachers of mathematics and chemistry.

At the Texas Woman's University, 20 out of 25 students completed the project and are teaching in the Dallas-Fort Worth school systems. And at Western Oregon State College, of 59 teachers, 29 attained basic or advanced math certification; the remaining students are either close to completing or have completed certification requirements.

The University of Northern Colorado ran a retraining program in physics. Student comprehension of the subject was measured using pre- and post-tests that had been standardized nationally for students completing one year of college-level physics. The pre-test scores for the 28 participants averaged below the 20th percentile of the national norm. Of the 28, 14 (50%) completed the program. Their post-test scores showed improvement, ranging from 30th-90th percentile, with three students remaining at the pre-test level.

In response to a questionnaire from the home site, 92% of the participants said they planned to teach mathematics as a result of the program, and 50% said they planned to continue graduate studies in math. They evaluated their courses highly and their faculty as outstanding. However, they did suggest changes to relieve the four-hour lectures and other program pressures. In the following year, then, course terms were extended, decreasing nightly lectures hours. Site directors were unanimous in their praise for the project and for the services received from Long Island University.

The program's design naturally established partnerships between participating universities and secondary schools, and between schools of education and math and science departments. Five awards for programs based upon THA-MASTER have been made to universities through funds under the Education for Economic Security Act. The New Jersey Department of Higher Education supported an additional site at Trenton State College.

The Pennsylvania Department of Education supported the program's continuation at Beaver College. And, as a result of THA-MASTER, Long Island University created the Institute for the Advancement of Mathematics and Science as part of the University College of Arts and Sciences, out of which the program operates.

What Activities Worked Unexpectedly?

The feasibility of conducting a cooperative program for improving preparation of mathematics and physics teachers between universities and neighboring school districts was easily confirmed. Project directors claim that the improvement of teaching and teachers is now seen by their universities and neighboring schools more as a collaborative effort than the sole responsibility of either.

Within universities, mathematics and science faculty began working together with colleagues in education. In one case, an educator was awarded a joint appointment with the mathematics department. As much as 15% of the teachers that came to the program were disenchanted with their current positions, but decided to remain in the profession because of the retraining opportunity.

Having districts select the teachers to be trained caused them to review the math and physics backgrounds of their system teachers and their teaching potential. School personnel became aware of the need to upgrade their teaching faculties and become more knowledgable about certification requirements and standards.

What Activities Didn't Work?

One of the evaluator's reports noted that the three paramount problems facing the dissemination sites were student recruitment, retention, and financial aid. For example, at one institution, a competing tuition-free program offered by the public schools in that community has attracted many of the students that made up its natural pool, forcing it to discontinue THA-MASTER.

At another site, even though 13 students became certified to teach math, failure to adhere to even the broadest outlines of the THA-MASTER model resulted in termination of the project.

What Do You Have To Send Others And How Do They Get It?

THA-MASTER can provide the following information and services to all interested parties, including rural, urban, suburban and special interest groups: course descriptions, videotapes, dissemination techniques, evaluation materials, networking contacts, speakers, consultants, technical assistance, and staff development.

For information and available services through THA-MASTER, write to:

Madeleine J. Long, Director
Institute for the Advancement of Mathematics and Science
Long Island University-Brooklyn Campus
1 University Plaza
Brooklyn, NY 11201
718-403-1056

Cost Efficiencies:

Several sites (Beaver and Arizona State) either reduced tuition or charged none for student participation in the program. Some occasionally absorbed the costs of needed facilities and of secretarial services and supplies.

What Has Happened To The Program Since The Grant Ended?

The number of dissemination sites now exceeds the three originally projected. Currently, the math or physics program is being offered at the following colleges, universities, and schools:

Arizona State University
Beaver College
Portland Maine public schools
Texas Woman's University
Trenton State College
Western Oregon State College
University of Northern Colorado
Long Island University (home-site)

THA-MASTER has become a permanent part of the mathematics graduate programs at three of these institutions: Texas Woman's University, Trenton State College and the University of Northern Colorado.

Even though there have been minor casualties along the way, generally, the model's adaptability has been tested and shown to transfer successfully to different sites. As noted, all dissemination sites have or will be having graduates, many of whom have been fully certified to teach math or physics in their states.

Other signs that these sites plan to institutionalize their programs are evident in graduate catalogues and budget designations. In addition, several sites hope to apply the model to additional disciplines of chemistry, earth science and biology. The current sites have raised in excess of a half million dollars to continue the effort begun under FIPSE funding. The universities and school systems of Puerto Rico have shown special interests in dissemination.

Within the first two project years alone, 150 dissemination inquiries were received. These inquiries are still coming in from state education departments and universities. Project staff recently advised math and science educators in Australia about adapting the program and raising funds for its implementation.

MADONNA COLLEGE
Educational Access for Hispanic Youth

Purpose of Project:

By preparing college-bound Hispanic students in math, science and English, the program seeks to retain them in high school and, at the same time, improve their college attendance and retention rates. In small, voluntary groups on Saturday mornings, and in six-week summer sessions, students learn what they failed to learn in earlier grades.

Innovative Features:

This project is neither complicated nor innovative; rather, it is a simple, proven idea that is worth replicating. Those students who plan to attend college participate in free tutoring workshops that coincide with the school year. Placement tests sort students into groups of similar ability. Six-week summer courses supplement these workshops and build basic competencies in English, physics, math, and computer science. Madonna faculty crafted the content of these courses and workshops to reinforce the high school curriculum at a language level appropriate for the students.

A somewhat innovative feature is the program's use of parents to recruit students and to gain support from the Hispanic community. Hispanic scientists visit the classrooms to highlight science, engineering, and computer science careers, those in which Hispanics are most underrepresented. And Hispanic professionals from Michigan industry, such as Michigan Bell Telephone, volunteer to serve the students as mentors and tutors.

Evaluation:

An external consultant coordinated program evaluation including pre- and post-tests of student performance in the summer courses, workshop appraisals, faculty profiles of students abilities, and a survey on student performance and program reactions. All evaluation measures yielded positive results on learning improvements and program benefits.

Impact or Changes From Grant Activities:

From 1986 to 1988, the program placed 76 out of 82 seniors in college; another 225 students in grades 9–11 have completed the tutoring program (See Table 2.)

Table 2

College Placement of High School Seniors

Year	Total Number in Program	Seniors in Program	College Placement of Seniors
1986	50	22	20
1987	50	28	26
1988	50	32	30
Totals	150	82	76

In January 1989 the project director contacted 10 randomly selected students in each past year of the program to determine college retention rates. Seven of the 10 in the program in 1986 were still in college; 8 of the 10 in 1987 were still in college; and 10 of the 10 in 1988 were still in college. The data suggest the program is succeeding in retaining students in high school and college.

In 1988, 47 of 58 enrolled students completed the six-week summer school as well. These numbers far exceed those predicted in the original objectives and what one usually expects from voluntary attendance programs. The project director explains the program's enrollment in several ways. Generally, parents and schools teachers have involved themselves in the program and have strongly encouraged students' participation. More specifically, school officials have even noted students' program attendance and performance on transcripts as special achievements and have awarded students extra credit.

On the attitudinal survey, a majority of students claimed they had improved their reading, math, and science abilities; these perceptions were confirmed by the results of pre- and post-testing. In fact, all students attending the workshops increased their math understanding and skills, and, on average, improved upon their pre-test scores by 20%. Part of these gains may be attributable to regular school studies because students were taught in the regular curriculum concurrently. During the summer school session, however, even greater gains were made in math and physics courses, with some students improving by as much as 25%. These gains are more probably the result of program activities.

Similar gains were made in writing and reading skills. In other words, all program students improved academically, some more than others. The attitudinal survey also showed that all

of the students expanded their ideas about learning and careers, and raised their educational aspirations. They all rated their teachers highly and expressed new academic self-confidence. All in all, the survey showed strong support for the program from its faculty, students, parents, and counselors.

What Activities Worked Unexpectedly?

The initial target group of juniors and seniors was expanded to include sophomore applicants and some seniors who had already graduated but wished to prepare further for college work. Pre-testing, employed initially to place all students that apply in academically appropriate classes, eventually served to screen out less motivated students from the applicant pool. This worked to reduce program participants to manageable numbers and to ensure high program completion rates. Community and campus interest in the program resulted in an Office of Multicultural Affairs to improve student retention, and a new Multicultural Student Association.

What Activities Didn't Work?

During the first year, the evaluator noted that after-school workshops fragmented the curriculum and produced spotty attendance. The program was changed to Saturday mornings with very positive results. More substantive changes were made when faculty and students opted to substitute solid content courses like physics for human relations workshops. Both difficulties, then, resulted in curricular improvements. However, a remaining problem is recruiting and motivating enough students to attend the English workshops on a regular basis.

What Do You Have To Send Others And How Do They Get It?

In addition to the final report submitted to FIPSE, brochures and a paper describing the educational access program and its results are available. Madonna College has been responding to such requests for program information for the last four years. Please write to:

Sister Mary Martinez
Madonna College
36600 Schoolcraft Road
Livonia, MI 48150-1173
313-591-5170

What Has Happened To The Program Since The Grant Ended?

After FIPSE funding ended, a grant from the State of Michigan, Office of Minority Equity, continued the program. In 1989 and under the auspices of a grant from the American Institute of Physics, a program modeled on this project for 9th and 10th grade students highlighted math and physics. Chances are good that these programs that take educationally disenfranchised youth and move them closer to the educational mainstream will become regular pre-college offerings at Madonna.

Now the program has expanded beyond Hispanics to include black and Native American students. By popular demand, a second program site was launched in Pontiac, Michigan, and its success has attracted the attention of other Hispanic communities in the state. Madonna's program has established strong contacts and good working relations with a variety of Hispanic agencies and with the school districts of Detroit and Pontiac, crucial communities that stand to benefit from widened educational access.

UNIVERSITY OF MISSOURI-COLUMBIA
Integrating Dispute Resolution Into First Year Law School Curriculum

Purpose of Project:

This project assumes that most American legal education is based upon a narrow, adversarial view of human relations and of the lawyer's role. This view contributes to the widespread public dissatisfaction with lawyers and to the delay, expense and stress often associated with litigation. The adversarial prospective pervades standard first year law courses that otherwise dwell on the study of appellate court opinions, thereby reinforcing the false notion that most disputes are resolved by going to court.

A major goal of this project was to give law students a more realistic picture of how good lawyers function and to add less adversarial perspectives to their legal education. To this end, law professors of first year students incorporated alternative ways of resolving disputes, such as negotiation, mediation, arbitration, mini-trials and summary jury trials, into all five standard first year courses (contracts, civil procedure, criminal law, torts, and property).

A final program goal—development of a dispute resolution textbook, along with an instructor's manual of classroom simulations and exercises—was the means to this end.

Innovative Features:

The project's basic idea of integrating dispute resolution into standard first year law courses breaks new ground in legal education. Students read about a given dispute resolution process, such as negotiation, participate in related exercises or simulations, and analyze them in class. Project staff assert that very few law schools, in their first year courses, single out dispute resolution processes for study.

Law professors at Missouri attended day-long training sessions on how to incorporate and teach this material within their regular courses. The project director helped each professor design and test classroom activities and made use of advanced law students as classroom observers and providers of feedback.

To support other institutions in teaching dispute resolution alternatives, project personnel developed a textbook and an instructor's manual, both of which could be used in a variety of course settings. Thus faculty members could adopt the materials without having to change the basic nature of their

courses. An additional innovation involved 24 professors at 14 law schools as collaborators in the preparation of exercises for the instructor's manual. This project was, in one evaluator's words, "nothing less than an effort to develop a unifying theme among the . . . disparate courses of the first year curriculum, and . . . an audacious departure from tradition."

Evaluation:

Process evaluation was built into many project activities. In the production of the course book, several law students, in addition to law professors and outside consultants, critically reviewed the manuscript. Likewise, the authors used feedback from law students (first year as well as advanced) about the dispute resolution exercises in the manual.

A number of outside consultants were engaged as evaluators: a legal sociologist at the end of the first grant year surveyed and interviewed students and faculty; and two prominent law professors, at the end of the second grant year, reviewed the book manuscripts and also interviewed students and faculty.

Impact or Changes From Grant Activities:

The program is now fully integrated into all first year standard law courses at Missouri. Beginning students are exposed to 8–10 dispute resolution segments during their first year.

Project staff were not able to document student learning, because dispute resolution exercises were not separately graded. Evaluators did document a high degree of acceptance of the idea of lawyer as problem solver and cited a heightened awareness of alternative dispute resolution, its place and application.

Obviously, it is not yet possible to gauge the influence of this approach to legal education on these students' later behavior. Realistically, the actual pressures of law practice and the perceptions of already practicing lawyers may make it difficult for these students to use alternative dispute resolution often. However, reasons for optimism do exist. Teachers and students report dispute resolution issues emerging in advanced courses and in a growing number of seminar papers.

The entire law school faculty at Missouri has become familiar with alternative methods of dispute resolution and expresses pride in this project, which has attracted much attention in the law school community. The first year teachers fairly regularly conducted the exercises they prepared as well as those contributed by faculty at other law schools. The Missouri law school dean was heavily involved in developing, promoting, and implementing the project, and remains one of its staunchest advocates.

The project effected a significant change in this law school's first year curriculum. Beginning students now routinely learn about alternative methods of resolving disputes. Although outside evaluators concluded the program is a bold innovation in legal education and applauded the uncommon collaboration among different law schools, the program continues to require coordination of faculty, of dispute resolution exercises, and of classroom activities each semester. It cannot yet claim a momentum of its own, independent of the project director.

What Activities Worked Unexpectedly?

The project's book, *Dispute Resolution and Lawyers*, has been used heavily in advanced dispute resolution courses in about 50 law schools. In at least six schools, it has been used in the first year legal research and writing courses.

What Activities Didn't Work?

Generally, the difficulty in persuading substantial numbers of traditional law professors to depart from accustomed methods was underestimated. For example, some resisted the notion of devoting regular course time to dispute resolution exercises, since they subtract from time available for instruction in the established subject matter. Some feared losing control of their classes when using simulations. Some students didn't take the resolution segments seriously because they were ungraded.

The project director assumed that dispute resolution perspectives would spread beyond the specific activities designed for the first year to advanced law school courses. This has not yet happened at Missouri.

What Do You Have To Send Others And How Do They Get It?

Copies of the books resulting from this project are available from:

West Publishing Company
Law School Division
50 W. Kellogg Blvd.
St. Paul, MN 55164–0526

L. Riskin and J. Westbrook, *Dispute Resolution and Lawyers* (hardcover and abridged editions, 1987); *Instructor's Manual with Exercises and Problem Material*, 1987.

Copies of an article appearing in the March 1990 *Journal of Legal Education* are available from:

Leonard Riskin, Director
Center for the Study of Dispute Resolution
University of Missouri-Columbia School of Law
Columbia, MO 65211
314-882-2052

L. Riskin and J. Westbrook, "Integrating Dispute Resolution into the Standard Law School Curriculum: The Missouri Plan."

What Has Happened To The Program Since The Grant Ended?

Consistent with the project's overall goal, dispute resolution is now taught throughout the first year law curriculum at Missouri. Currently, program discussions center around producing demonstration videotapes to accompany resolution exercises and expanding program coverage to include advanced courses. The school has opened a mediation center for law students to observe and conduct real mediations. In the long run, the program hopes to broaden its perspective toward both prevention and resolution of disputes. The program has received another FIPSE grant to make these demonstration videotapes and to conduct a comprehensive evaluation of the project.

Saint Louis University Law School has adopted the abridged course book for use in its first year sections, as have Pepperdine, William and Mary, Washington and Lee, the University of Dayton, and six other law schools. There will probably be other adoptions in coming semesters.

Sixteen professors at 12 other law schools are using some of the exercises in their first year courses, although they have not adopted the textbook. The hardcover edition was adopted for use in advanced courses in about 15 law schools during the first year it was available. During 1988-89, the books were used in 55 different law schools. The course book has received two very favorable reviews in the law press. One reviewer called it "an outstanding contribution to the field of dispute resolution . . . and of the few works that provide a basis for integration of subject matter with the standard curriculum. . . ."

The books produced by the program and the publicity surrounding it have helped faculty elsewhere learn more about dispute resolution and how it may be integrated into their courses. Increasingly, large law firms across the country are developing and publicizing expertise in dispute resolution, and a number of similarly oriented books will soon be on the market. The project director and other UMC law professors have made about a dozen presentations on the project to large gatherings of law professors.

UNIVERSITY OF MISSOURI–ST. LOUIS
Gateway Writing Project: Composing, Computers and Contexts

Purpose of Project:

Since 1978, the Gateway Writing Project has sponsored intensive workshops for teachers of writing. It is one of 160 sites that constitute the National Writing Project, founded at the University of California-Berkeley to meet an increasing demand for highly skilled writing teachers. The effectiveness of its general approach of teachers teaching teachers about writing has already been established through extensive writing research.

By 1984, the availability and accessibility of microcomputers in the schools mandated a new kind of teacher training. Gateway's aim in this project was to help teachers use computers in writing instruction, not to focus on computer literacy or to test the efficacy of computers in writing.

In addition, this project retained the National Writing Project's stress on teachers teaching teachers. To reach these goals, Gateway embarked on a three-pronged program of:

- faculty/staff development, including presentation of current research on the composing process and writing and publication of papers by teacher participants;
- research on writing, using descriptive ethnography to generate research questions; and
- support for instructional change in writing, using writing improvement teams consisting of project-trained teachers and administrators.

Innovative Features:

Gateway's innovation was using school-based writing research to design a faculty/staff development program, blending training and research. At the project's inception, there was no model for Gateway's ideal of integrated training in teaching writing with computers.

Gateway's strategy was to bring back to the University of Missouri-St. Louis their strongest graduates from previous years' writing programs to a summer institute where they would write with computers and learn about new research on word processing and writing. During the next school year they would do classroom research on various ways to employ computers in teaching process-oriented writing. The

experiences of the teacher/researchers would fine tune Gateway's model for future summer institutes.

The project staff suspected that strong computer-assisted writing programs require both systemic and instructional changes. Therefore, they provided seminars for school administrators to assist in the formation of "writing improvement teams" consisting of project-trained teachers and other resource people. They identified several pilot schools where they could work closely with these teams and learn more about the impact of computers on each school's approach to literacy. It is noteworthy that during each of the six years they have offered a summer institute in teaching writing with computers, a larger percentage of the material is drawn from the work of their own project graduates and from the experience of the local schools. Project staff believe this added greatly to the credibility of the training.

Evaluation:

Formative evaluation was the core of this project, looking most carefully at the work of teachers and students in classrooms during the school year.

First, project staff examined the individual writers, participating teachers as well as their students. Their data included holistic assessment of writing samples and several detailed case studies that included keystroke-replay of student composing sessions and cued retrospection interviews. (Prior to the introduction of computers, the project had already assessed its overall impact on students. A 1979 assessment of 2,816 test essays had showed greater gains in writing for students having Gateway teachers than in the comparison groups.)

Second, the staff widened the focus to look at the writing classroom and writing instruction. Small-scale qualitative research has been a rich source of program findings about writing. Here the data were fieldnotes from participant observation in the classroom of three different project-trained teachers who, despite their common approach to the writing process, were found to emphasize different aspects of that process. Three different revision emphases (fluency, word choice, and mechanics) were identified in the fieldnotes and then traced in student writings. Interestingly, computers promoted no single type of emphasis, but made revisions of all kinds easier.

Third, the focus was widened further to evaluate the impact of computers on the school building. Primarily, data were drawn from records of the writing improvement teams, including a written report from each pilot site.

The success of the project's implementation varied considerably from site to site. What was learned at each of these levels—the individual writer, the writing classroom, and the school building—was applied to revise and improve the training model.

Impact or Changes From Grant Activities:

During the past five years, Gateway has refined a model for using computers in the teaching of writing that has gained wide acceptance in the St. Louis area. As a direct result of its training programs, dozens of area secondary schools now have computer-equipped writing centers—most staffed by Gateway graduates. The project has achieved its goal of integrated staff development in that the computer is woven almost invisibly into writing: participants in Gateway's workshops learn word processing in the context of the writing process. Further, all four pilot school sites have active, computer-equipped writing labs and some classes that emphasize the writing process.

Many factors were found to affect a writing improvement team's impact on the school: the principal's commitment to district goals for writing, computers, or both; the leadership of a chair or language arts committee; the Gateway teachers' status in the building; and the cohesiveness of the writing staff.

Impact on Students: Between 1984 and 1989, 130 teachers from the primary grades through college completed the four-week invitational Gateway graduate institute on teaching writing with computers. These teachers have gone on to apply what they learned to their own classroom teaching, to lead short workshops for other teachers, to conduct writing research and to publish their findings.

Impact on Administrators: Gateway's full day administrators' seminar has been offered annually since 1984 to audiences varying in size from 15 to 30. Administrative support in the pilot schools has been erratic and, at times, difficult to garner. Yet, several sites have administrators with backgrounds in teaching writing and with interest in computers. These leaders have been used to conduct seminars for other administrators. However, the project has not managed to develop supportive administrators from those lacking personal experience either as English teachers or as computer users.

Impact on Institutions: In 1984, Gateway had no official status. Though recognized by the National Writing Project as a site, to its home university it was simply a summer school course and a source of minor consulting income during the year. Today it is featured in University catalogues, promotional literature,

and speeches from the chancellor's office. It has strong ties to the English Department, the Extension Division and, to a lesser extent, the School of Education. When the project first began, there was real doubt in the English Department that a course in writing for teachers could justify graduate credit; today Gateway courses are known to be rigorous and their graduates are routinely approved to teach workshops off campus, some of them for graduate credit. These changes represent a dramatic rise in the project's institutional credibility.

The experience of the past five years has confirmed the importance of Gateway's teacher-centered, school-centered plan, and that the computer is not a treatment or a quick-fix for the nation's writing problems. The complexity of planning computer-enriched writing programs proved even greater than anticipated—solving such issues as space, time, access, and equity. An individual classroom teacher is much more autonomous when teaching writing with pen and paper—tools available anywhere—than when teaching with the myriad constraints of software, lab schedules, and after-school access to writing tools. Thus, future programs of computers and writing should continue to stress the classroom context and the total school learning environment.

What Activities Worked Unexpectedly?

In some ways, introducing computers into writing instruction turned out to be easier than expected, in part because computers proliferated so rapidly in the schools during the grant period. Anticipated problems, such as children's lack of keyboarding skills and teachers' computer anxiety, were actually of minimal importance.

The computer had unexpected advantages in teaching the writing process. Far from detracting from the focus on writing, the computer enhanced it. Since most schoolchildren and teachers did not have computers at home, most writing had to take place during class time. Process theorists have long urged that the writing classroom should look like an art or physical education class, not like a lecture hall. Computers almost inevitably bring about this transformation, as the writing process becomes more public, the central event of each day's class, and visible on the monitors and in pages of marked and revised printout.

Working with the Extension Division turned out to be unexpectedly effective. In the past, the few Gateway workshops run by Extension had seemed overpriced and administratively awkward. Since all of its programs must pay for themselves, the Extension staff was suspicious that Gateway was more a service operation than a money maker.

Having the FIPSE grant changed that image. Extension eventually hired a Gateway trained teacher to coordinate inservice workshops, handle contracts and budgets, and consult with schools. They also printed catalogues and brochures. The arrangement still relies on some financial support from the grants and the University, but the result has been a huge increase in training and far greater visibility for Gateway.

What Activities Didn't Work?

The writing improvement teams at the pilot schools were sometimes marred by staff transfers and erratic administrative support. An unexpected difficulty was that some schools asked to be pilots, then sent mediocre teachers to the invitational summer institutes. These teachers were not able to become strong leaders for program development in their buildings.

When a strong, writing and computer-oriented administrator already existed, and talented, dedicated writing teachers were trained, teachers easily learned to use computers in writing. But Gateway did not succeed in developing this talent where it did not already exist. Staff thought their considerable experience working with the schools would prepare them to build writing improvement teams, but they found they needed to learn still more about guided change in the public schools. They also found that when computers enter writing programs, administrative leadership becomes absolutely necessary. Teachers cannot normally purchase software, set up labs, or schedule classes without such support.

In addition, project staff found they were mistaken in assuming that the University would soon purchase more microcomputers, especially Apples, which would then be available for Gateway workshops on campus. The University lab facilities are far behind those of public secondary schools in the area.

What Do You Have To Send Others And How Do They Get It?

Dissemination has included six curriculum guides and dozens of articles and conference papers that have reached a wide educational audience. A book by the project director, *Writinglands: Composing With Old And New Writing*, reporting on the school-based research has been accepted for publication by the National Council of Teachers of English.

Published materials are available in professional journals and through the Educational Resources Information Center (ERIC). A complete list of published and in-press articles, unpublished materials, conference presentations, media software, and

videotapes can be obtained from the project director at the address below.

Jane Zeni
The Gateway Writing Project
English Department
University of Missouri-St. Louis
St. Louis, MO 63121
314-553-5541

Cost Efficiencies:

Most of the project's activities have been insitutionalized, either as regular University credit courses, as extension programs, as faculty consulting, or as activities funded by Missouri incentive grants to individual Gateway teachers. To the degree that Gateway has been able to "piggyback" on already-funded programs, costs have been saved. For example, it has co-sponsored conferences and publications with the Greater St. Louis English Teachers' Association, and project-trained teachers have been hired to lead off-campus workshops through UM-St. Louis Extension.

What Has Happened To The Program Since The Grant Ended?

The Gateway Writing Project's role within the University is now reasonably secure. Funding and staff have been budgeted by the Extension Division and by the College of Arts and Sciences, with additional support from the English Department and the School of Education. Two Gateway courses are listed in the college catalogues and the project has influenced the undergraduate composition and preservice English education courses.

Beginning in 1986, Extension hired a Gateway teacher as a program specialist to promote and arrange inservice workshops. This position has grown to 60% FTE and programs have doubled in three years. Secretarial support is provided by Extension and by the English Department. Gateway has been written into the Five-Year Plan by both Extension and English at a proposed budget of $50,000 per year. A small matching grant from the National Writing Project has funded a partnership with Harris-Stowe State College, an historically black teachers' college which is now sponsoring Gateway workshops in St. Louis. HSSC now has its own Gateway co-director and board, shares the cost of a joint brochure, and hopes to institutionalize the project as Missouri has done.

The program itself has been shared with educators across Missouri and in two foreign countries. Three pioneering labs founded by Gateway staff have been named Centers of Excellence by the National Council of Teachers of English. Staff took part in a computer teleconference on writing, producing an article between co-authors separated by 1,000 miles. The program's latest undertaking is organizing six state sites as the Missouri Writing Projects Network to influence writing curriculum statewide.

UNIVERSITY OF OREGON

(Project begun at Washington State University)

Microcomputing Laboratory for Integrative Learning in Physiology

Purpose of Project:

This project, guided by a pedagogy for teaching science that emphasizes open-ended problem solving, developed two microcomputer-based laboratories and a fault identification game for teaching physiology. Within these simulated laboratories, "realistic" problems capture the essence of science as it is practiced in that problem solvers must recognize that a solution proceeds by multiple pathways with competing, simultaneous hypotheses. Simulation exercises teach students integrated problem solving while eliminating the need to use live animals and costly equipment in laboratory experiments.

Innovative Features:

Project staff developed two microcomputer simulation programs, Cardiovascular Systems and Dynamics (CVSAD) and Pulmonary Mechanics Laboratory (PML), to answer the limitations of traditional wet laboratories. These microcomputer-based laboratories, or microworlds, present a wealth of experimental features, simulating either a single animal in many organic preparations or many animals in a single preparation. Students can manipulate properties and observe behaviors at both the isolated component and the integrated system levels.

The simulations permit students to perform experiments that are conceptually significant, but realistically difficult or impossible. CVSAD and PML stress self-directed exploration. Their non-tutorial methodology requires that students participate actively in the formulation of hypotheses and the design of experiments to test those hypotheses. In order to acquire new knowledge, students must exercise their abilities to pose relevant questions and perform revealing experiments. Learning is a dynamic process of both exploration and discovery and students develop and refine the intellectual skills for using knowledge in practical ways such as arriving at diagnoses and designing therapies. Both programs run on IBM PC or compatible computers with color graphics and 8087 math co-processor.

Evaluation:

Evaluation focused on students' ability to master complex systems rather than individual components of systems, especially through the Fault Identification Game (FIG) for diagnosing physiologic problems. The aim was to measure students' transition from unconnected, non-integrated thinking to richly connected, integrated problem solving.

To this end, an evaluation of the FIG was undertaken involving 40 veterinary medicine students. All had had conventional lectures as introduction to the cardiovascular system. A pre-test instrument collected data that allowed project staff to construct students' mental maps of cardiovascular system properties. Then students solved 50 diagnostic problems in an early version of the FIG. A post-test collected data from which second mental maps were constructed. The pre- and post-test maps were compared to learn whether the FIG had enhanced students' ability to solve problems by synthesizing knowledge, i.e., the way experts do.

The two simulations of laboratories were evaluated in use through student and faculty feedback as they experienced the systems. Students reported that they had little trouble using the simulations, appreciated the elimination of live animals in laboratory work, and felt they learned more this way. Faculty reported that the graphical tutors created to introduce complex concepts in the simulations saved them significant instructional time and improved the quality of their examinations by allowing them to ask deeper more probing questions.

Impact or Changes From Grant Activities:

Evaluation results showed the use of the fault game altered students' mental maps in (1) shifting from early emphasis on anatomic features to the functional interactions among system parts, and (2) scoring on post-test mental maps that was significantly closer to the test scores of experienced scientists. The evaluation showed that students learned to make connections between system components as the scientists did. Thus, the fault-finding exercise was effective in teaching integrative thinking for these students.

More than 130 sites worldwide, including western Europe, Canada, Australia, and New Zealand, have purchased one or more copies of the first simulation program, CVSAD. Fully one-third of the U.S. medical schools own it. It is also being used in graduate and professional schools of pharmacy and veterinary medicine. Several undergraduate biology departments have incorporated it into their curricula as well. CVSAD users have readily adopted the pulmonary program,

and some have even requested an adequate supply of software and student manuals to develop a whole physiology course. Below are sites that have purchased CVSAD.

Institutions that have one copy of CVSAD:

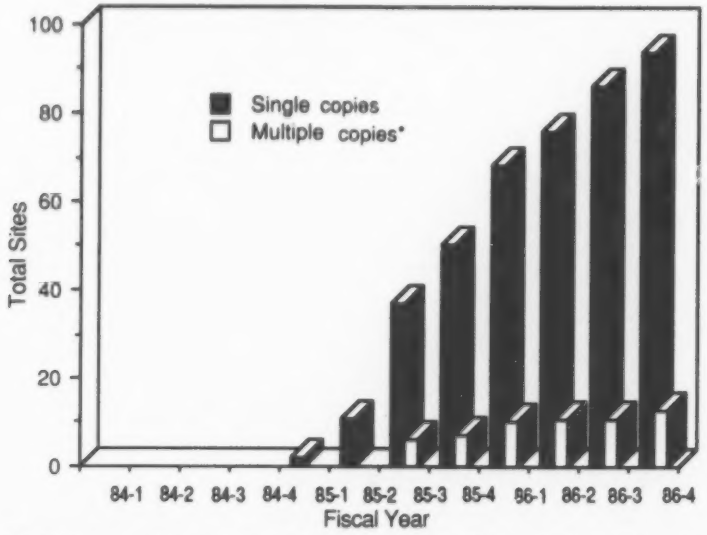
Arizona, University of
Arkansas, University of
Armed Forces Radiobiology Research Institution, Md.
British Columbia, University of, Canada
Calgary, University of, Canada
California State University
California, University of, Berkeley
California, University of, Davis
California, University of, San Diego
City University of New York
Colorado State University
Cornell University, N.Y.
Duke University, N.C.
F. Hoffman-La Roche & Co., Switzerland
Iowa State University
Johns Hopkins University, Md.
University of Kansas
Loyola University, Ill.
Massachusetts General Hospital
McGill University, Canada
Michael Reese Hospital and Medical Center, Ill.
New Mexico, University of
New York State University, Buffalo
North Carolina, University of
North Carolina State University
Ohio State University
Oklahoma, University of
South Carolina, University of
Southern California, University of
St. George's University, Grenada
Temple University, Penn.
Tennessee, University of
Tufts University, Mass.
University College, Dublin, Ireland
University College, London, England
Vermont, University of
Virginia Polytechnic Institute
Washington, University of
Wisconsin, University of
Yeshiva University, N.Y.

Institutions that have more than one copy of CVSAD, indicating that it may be being used as a hands-on laboratory (number of copies in parentheses):

California, University of, Los Angeles (7)
Case Western Reserve University, Ohio (15)
Colorado, University of (5)
Guelph, University of, Canada (2)
Iowa, University of (2)
Manitoba, University of, Canada (2)
Maryland, University of (5)
Nebraska, University of (20)
Rochester, University of, N.Y. (2)
Texas, University of (5)
Thomas Jefferson University, Penn. (7)
Tuskegee Institute, Ala. (4)

A survey of CVSAD owners indicated that 66% are using it in a variety of ways: as library reference, lecture aid, small group demonstration, or hands-on student activity. Ten percent have purchased multiple copies and use it regularly in student computer labs, and another 8% have written their own student handouts to accompany the program's assignments. Figure 1 shows its progressive use since the grant's beginning in 1984.

Figure 1
Quarterly Report of Total CVSAD Sites Worldwide Since Beginning of FIPSE Grant.



*Multiple copy sales grow more slowly, but indicate the greatest commitment to using the software.

What Activities Worked Unexpectedly?

Contrary to expectations, there was no need to develop special purpose hardware to meet the high computational demands of the simulations. In fact, as the project developed, both hardware and software tools developed more rapidly than project needs.

What Activities Didn't Work?

Despite enthusiastic reactions to the program, 34% of the original users report that they are not now using CVSAD. More distressing, 18% cite inadequate or total lack of equipment as the prohibiting factors. Furthermore, two-thirds of the users attempting hands-on student labs have only one copy of the program. Many curricula do not even provide sufficient time to include in-depth laboratory activities.

This project revealed a disturbing lack of computer equipment for educational use in medical and veterinary schools. Few institutions have demonstrated enough commitment to instructional computing to provide their students with adequate quantities of even the most basic personal computer systems.

The simulations, CVSAD and PML, were published by a small computer consulting firm. This had the advantage of quick and

responsive service, but as time progressed, the small size of the publisher limited the project's ability to expand beyond its initial target audience of medical educators.

What Do You Have To Send Others And How Do They Get It?

Information about the project has been actively disseminated by a variety of means. Foremost among these has been demonstration of the software annually at the Federation of American Societies of Experimental Biology meetings. This conference attracts several thousand scientists and teachers and provides a forum for hands-on demonstrations to several hundred people each year. Additionally, papers authored by project staff have appeared in several learned journals and have described the simulated laboratories, the impact of diagnostic problems on understanding complex systems, and the idea of an integrated science laboratory.

Copies of the software may be obtained from the publisher:

Command Applied Technology
P.O. Box 511
Pullman, WA 99163-0511
501-334-6145

CVSAD costs $150 for one copy and $50 for each additional copy when four or more are ordered. Included with the program is a 150-page instructor's manual.

The Fault Identification Game was distributed as freeware by giving it to all interested visitors to the biology conference demonstrations and by mailing it to the owners of CVSAD and PML.

For further program information write to the project directors:

Nils S. Peterson or Sarah A. Douglas
Department of Computer Science
University of Oregon
Eugene, OR 97403
503-345-7749

Products

Project products, reports, and articles are listed below:

Feiner, S.A. and N.S. Peterson. 1986. *Pulmonary Mechanics Laboratory*. Command Applied Technology, Pullman, Washington.

Peterson, N.S. with D.R. Armstrong. 1985. *Cardiovascular Systems and Dynamics*. Command Applied Technology, Pullman, Washington.

Peterson, N.S. and S.A. Feiner. 1987. *Fault Identification Game*. Freeware. University of Oregon.

Major Reports and Articles

Feiner, S.A. and N. Peterson. 1987. Simulations in physiology: Developing integrative thinking. *Academic Computing*, 1(1): 27–29, 63.

Hopkins, R.H., K.B. Campbell, and N.S. Peterson. 1987. Representations of perceived relations among the properties and variables of a complex system. *IEEE Trans Sys. Man and Cyber.* SMC–17(1), 52–60.

Peterson, N.S., and K.B. Campbell. 1985. Teaching cardiovascular integrations with computer laboratories. *The Physiologist 28:* 159–169.

Peterson, N.S., K.B. Campbell, R.H. Hopkins, and S.A. Feiner. 1985. An integrated cardiovascular teaching laboratory. *The Physiologist 28:* 447–448.

Peterson, N.S., K.B. Campbell. 1986. Designing interfaces for microcomputer simulations that teach integrative physiology. *Trans. Summer Computer Simulation Conference*, Society for Computer Simulation, La Jolla CA, 390–394.

Peterson, N.S., J.R. Jungck, D.M. Sharpe, and W.F. Finzer. 1987. A design approach to science. *Machine Mediated Learning 2:* 1&2, 111–127.

Peterson, N.S., T.Y. Kagehiro, and K.B. Campbell. 1987. Real-time cardiovascular simulation using two microprocessors. *Mathematical Modelling 7*, 929–940.

What Has Happened To The Program Since The Grant Ended?

Publicity has been invaluable to the widespread acceptance of both the project's teaching tools and pedagogy. Articles appearing in both popular press and academic publications have brought CVSAD and PML to the attention of scientists, educators, and other software designers. Direct mail marketing has been targeted at the 180 medical and veterinary schools in the United States.

The project has also served as the basis for three other grants. One from FIPSE is developing a biology laboratory construction kit with intelligent tutoring. It sets out to create more flexible simulations where students construct cardiovascular systems of their own design. Based on suggestions and improvements from CVSAD users, the National Institute of Health funded a second project to create a new textbook with simulations and a diagnostic tutor. The

Fault Identification Game tutor has been enhanced with an on-line tutor. The third project is BioQUEST funded by the Annenberg/CPB Project. BioQUEST is assembling a freshman biology course from modules developed by a number of faculty, including appropriate material from CVSAD.

SALISBURY STATE COLLEGE
The Mathematical Competition in Modeling

Purpose of Project:

Undergraduate mathematics is the keystone to research and knowledge in the natural sciences, economics, engineering, computer science and other fields. And yet we live in an era of alarmingly low math proficiency—a situation in which too many students know too little math. To enhance the presence of mathematics on college and university campuses nationwide, the Consortium for Mathematics and its Applications (COMAP) sponsored a Mathematical Competition in Modeling (MCM) each grant year from 1985 through 1987, and it continues today. COMAP is the largest source of materials in undergraduate mathematics application.

Innovative Features:

This mathematical contest differs from the well-established Putnam Competition in the following ways: the math problems are open-ended and do not have a single or clear solution; students work in teams of three for an entire weekend to solve one problem they have selected from a set of two, and may use books, notes, and computers to derive solutions. Over 150 teams of undergraduates from 118 higher education institutions participated in the final grant year competition.

Evaluation:

Four indicators of program success were used: yearly contest participation rates, quality of submitted papers, responses to an opinion questionnaire and numbers of invited presentations by mathematical associations.

All submitted solutions to the math problems were judged by a chief grader and 10 associate graders from various colleges and universities, who classified the solutions as: "Successful Participation," "Honorable Mention," and "Meritorious." Each year, selected Meritorious papers have been published in national, refereed journals.

Impact or Changes From Grant Activities:

For each year the project operated and the contest was held, there was a 30% increase in the number of entries over the year before, for example, from 118 team submissions in 1986 to 156 in 1987. Project staff have noted an increase in quality and number over the three-year period not only of submitted solutions but of student presentations of results to regional and national meetings of major mathematical organizations such as the Mathematics Association of America (MAA), Operations Research Society of America (ORSA), and the Society for

Industrial and Applied Mathematics (SIAM). A final indication of project impact is the publishing in 1987 of the four top entries in a special issue of an international research journal, *Mathematical Modeling* (Pergamon Press, Volume 9, Number 10), devoted entirely to this competition, with the project director as guest editor.

Changes in the curriculum to reflect the importance of mathematical modeling represent the most gratifying way the contest might influence mathematics on campuses nationwide. The project staff are more confident about this change now than in years past since MCM has been given backing by both SIAM and ORSA. The latter contributed graders, prizes, and memberships, as well as its endorsement.

The project director concludes that "the 1985, 1986, and 1987 contests suggest there is a good nucleus of budding modelers in [our] schools." In fact, about 40% of the participating teams receive some type of official recognition such as travel funds from their colleges and universities. Some MCM winners have gone on to receive "enhanced" graduate assistantships and two winning teams received cash prizes and fully-paid trips to professional meetings.

What Activities Worked Unexpectedly?

Unexpected yet welcome results were the rapidly increasing interest in this applied mathematics activity; the strong showing by small colleges; and the ease and efficiency with which students can learn to solve problems collaboratively.

What Activities Didn't Work?

Challenges to project staff included designing suitable math problems, recruiting competent graders, and managing the grading process. First and second year experiences with these issues led to third year refinements.

What Do You Have To Send Others And How Do They Get It?

Solutions from all three years of winning teams are available in standard math publications. In addition, MCM announcements describe contest rules and guidelines and include selected MCM questions from previous years. The project director is a regional representative for TEAM, an NSF project that produced six video tape modules on modeling.

For background information on MCM, contact the project director for a 1985 article in *Mathematical Modeling*, Volume 6.

For these materials, write to:

B.A. Fusaro
Department of Mathematical Sciences
Salisbury State College
P.O. Box 2195
Salisbury, MD 21801
301-543-6470

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Cost Efficiencies:

The major contest expenses, which vary with the number of contestants, include grading, released time for the project director, and mailing. Special cooperation from Salisbury State has kept two of these costs unusually low by having grading done on campus, using on-campus housing for graders, and subsidizing released time for the project director. Other costs associated with maintaining a contest data base and preparing announcements are covered by COMAP.

What Has Happened To The Program Since The Grant Ended?

The Mathematical Competition in Modeling is being supported in part by several leading applied mathematics organizations and has, to some extent, been institutionalized at Salisbury State College with the primary support coming from COMAP. Currently, special long-term funding is being solicited from other sources to replace COMAP funds.

In 1985, the contest involved 70 colleges, with 90 teams. The 1989 contest doubles that initial number of institutions to 143, with 211 teams. Six of the Meritorious solution papers will be published in the *Journal of Undergraduate Mathematics and its Applications*, a COMAP publication. The 1990 contest was held in February.

SOUTHERN REGIONAL EDUCATION BOARD
Improving the Pass Rate of Minority Students on Teacher Certification Examinations

Purpose of Project:

The project was designed to address the problem that many minority students preparing to teach—especially those attending historically black colleges and universities—fail teacher certification examinations.

Project sites were Coppin State College in Baltimore, Maryland; South Carolina State College in Orangeburg, South Carolina; and South University in Baton Rouge, Louisiana. Faculty and curriculum development and assessment were used to correct deficiencies in general education and improve students' reading and analytic skills. The ultimate goal of the project was to develop a model which could be replicated nationally and that would help to increase the number of minority public school teachers.

The main features of this approach were:

- providing training in test construction and item analysis to a cadre of faculty and administrators who will train other faculty;
- establishing teacher education centers that maintain files of tests and practice materials helpful in improving students' test performance;
- revising course content to parallel teacher certification tests;
- teaching faculty how to review curricula and construct syllabi better;
- giving faculty practice in administering standardized tests and giving students practice in taking such tests; and
- developing cross-disciplinary programs to increase reading comprehensive, speed, and vocabulary.

Innovative Features:

This was an institutionwide undertaking that brought liberal arts and education faculties together to improve students performance. It gave equal attention to students, faculty, and the curriculum. Its teacher centers not only maintained

certification test files but provided computers for self-instruction on the tests. Because many minority students do poorly on the reasoning and analytical skills portion of the National Teachers Examination (NTE), the participating institutions prepared students by having them practice test items in these skills on computers.

Consultants instructed education and liberal arts faculty and administrators about testing, about the concepts of reliability and validity of tests, about the notions of item difficulty and item discrimination, about flaws in question construction, about developing test items for different disciplines, and about statistical analysis of tests.

Evaluation:

In addition to periodic formative evaluation to monitor progress, an external evaluator made annual site visits to all participating institutions each year and to the offices of SREB, reviewing project records and conducting interviews. Available student pass rates on standardized tests were collected and compared from the three campus sites.

Impact or Changes From Grant Activities:

The cadre of trained faculty, 13 from the arts and sciences and 7 from education, doubled the number of institutions they worked with to improve student test performance. Each institution added new courses, revised others, launched reading and writing programs, assessed student test preparedness, and developed items for test banks.

All participating sites have institutionalized curricular changes, syllabi revisions, and the new testing programs, and are continuing to provide support for the teacher centers. A model to improve students' test performance using the centers has evolved, and trained faculty are prepared to help others implement it.

As a result of the SREB project, each institution is trying to build a strong liberal arts base as well as improve students' writing and reading skills. Poor showing on the NTE point to these weaknesses that cannot be overcome with education courses. This finding plus faculty activities in the teacher centers led administrators to conclude that preparing students to meet the new, more stringent standards in teacher education can only be achieved through joint action between education and liberal arts faculties and visible senior leadership from administrators.

Data on national teacher examination pass rates for students in the participating institutions have been very difficult to obtain for several reasons. Students can apply to take the NTE

without notifying their educational institution. In addition, test scores are only sent to the students themselves and to the State Department of Education. So there is no automatic feedback to the institutions about which students took the tests and how they performed. Currently, the project director is conferring with participating site coordinators and the Educational Testing Service to remedy this by channeling group and/or individual test scores to the institutions.

Indirect indications of student improvements can be noted from other standardized tests. From 1981 to 1982 and from 1986 to 1987, one institution reported increases in program students' GRE verbal, quantitative, and analytical scores from 298 to 319, 280 to 313, and 317 to 327, respectively.

Between 1986 and 1988 at another institution, the percentage of teacher education majors receiving passing scores on the Education Entrance Examination increased from 54% to 71% in reading, from 62% to 66% in mathematics, and from 81% to 94% in writing. A third institution, with admittedly incomplete data, noted an increase from 1984–85 to 1987–88 in their overall NTE pass rate from 42% to 82%.

What Activities Didn't Work?

At one institution, faculty strongly resented the project. Had they not seen it as a device for preparing to meet state mandates in teacher education, it is unlikely they would have cooperated. Project staff recommend that liberal arts faculty be provided adequate orientation to teacher education preparation and state certification requirements before participating in such a program.

An additional need identified is a detailed strategic plan that includes specifically focused objectives, activities, staffing responsibilities, roles and duties of consultants, target dates, expected outcomes, and evaluation mechanisms for both formative and summative components. The need for such a plan was underscored by the considerable monitoring and coordination by SREB of faculty and consultants required to implement this project at three sites.

What Do You Have To Send Others And How Do They Get It?

Below are examples of materials available from the project director:

- Course syllabi
- Listing of software, studies, and teacher certification testing materials on reading and writing across disciplines

- Guidelines for writers of examination questions and samples of teacher-made tests; item writing background information
- Handouts and transparencies on the institutional model
- Guide to National Teacher Examination Core Battery of Tests

In addition to these materials, the project director will provide copies of reports about all the projects and ways to contact the campus coordinators and principal consultant. Write to:

W.C. Brown, Senior Consultant
Southern Regional Education Board
529 Tenth Street, NW
Atlanta, GA 30318-5790
404-875-9211

What Has Happened To The Program Since The Grant Ended?

All institutions reported that curricular changes, revised syllabi, test banks, and reading and writing programs are now integral parts of their academic programs. Work continues on curricular upgrading and test bank development.

Project staff persist in their efforts to acquire student NTE test scores so that score differences can be noted over the project years and subsequently. The project director and coordinators from participating sites recently devised a reporting form to be used in systematizing test data collection. It provides for a profile of each site's program enrollment and graduation, as well as student test performance by race and specialty NTE test areas of art education, biology, business education, and early childhood education.

The education and liberal arts faculties continue joint efforts to improve teacher education programs, and SREB continues to press for higher student pass rates on teacher certification tests. One institution credits the project with its massive undergraduate program reorganization taking place, another as a catalyst in winning a grant to sustain writing programs. And, as a direct outgrowth of the program, another site acquired state funds to extend substantially their teacher education center's faculty development and instructional activities statewide.

UNIVERSITY OF VIRGINIA
Teacher Training Through Computer Simulation

Purpose of Project:

The Curry School of Education produced realistic and versatile computer simulations that approximate life in actual classrooms for training preservice teachers. The project developed, tested, and disseminated these simulations on both fundamental teaching and classroom management skills. Without simulations, students preparing to teach experience limited direct interaction with pupils in classrooms. This is a frequent criticism of teacher training, especially as it pertains to entry-level education students, and one that this project set out to rectify.

Innovative Features:

Entry-level students use the simulated classrooms to translate their course knowledge about teaching into practical behaviors. Powerful learning concepts, such as reinforcement, feedback, and prompting, are coupled with realistic computer-controlled class interactions. Students assume the role of teacher with a class of simulated pupils. They practice the skills of how to control instructional time, how to question and respond to pupils, and how to manage disruptive classroom behaviors. The teacher-educator who uses the simulation as a training tool can preprogram any combination of target behaviors for an upcoming teaching session.

As with any simulation, its practical significance depends on how well the skills learned actually transfer to real-life settings; the closer the match between the real and simulated settings, the more likely the skills will transfer effectively. The simulations reside in easy-to-use menu-driven modules, run on standard IBM microcomputers. To heighten the environmental reality of a classroom, speech synthesis hardware was introduced to simulate direct dialog with computer pupils. The new voice technology allows this instant communication, a distinct advance over slower system operator responses.

Evaluation:

The simulation software produced a session-by-session customized record of performance, tracking students' comparative levels of teaching and behavior management proficiency. Through the use of these progress records, teacher-pupil interactions were reviewed following each lesson. A trained counselor noted those instructional actions that were effective and those that were not.

Extensive inhouse testing of the modules took place in 11 separate studies, involving 342 education students and 34 experienced teachers. Analyses of performance changes attest to the simulation's effectiveness in teaching instructional and behavior management skills. The final test of the simulation's instructional value will come, however, with the evaluation of the transferability of skills to the classroom.

Between 1984 and 1987, field validation studies at several teacher preparation institutions also yielded promising results and support from key simulation users. Both the inhouse and field testing assessments were used to create a final training package, complete with software and appropriate documentation.

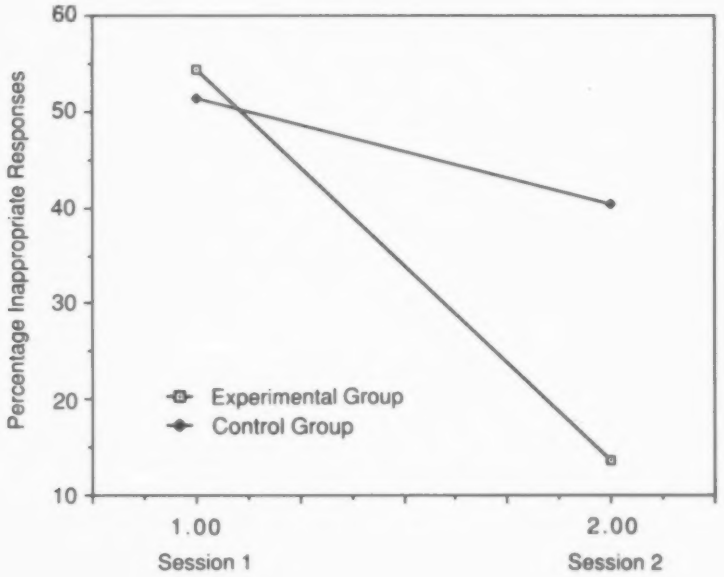
Beyond behavioral changes, students' post-training ratings also confirm the simulation's impact. For example, 90% of the 1987 fall participants rated the simulations as very useful for beginning teachers.

Impact or Changes From Grant Activities:

Student proficiency in three teaching categories dramatically improved across the simulation training sessions, especially time management skills. When the first session was compared to the last, improvement ranged from 27% to 76% for different skills. Furthermore, follow-up records showed that, once trained, students maintained skills over several months. The novice teachers made such progress that their post-training scores came close to the pre-training scores of a group of experienced teachers.

A two-session study conducted the first year of the project was designed to assess the simulation's impact on training classroom management skills. Subjects in the experimental group received feedback on classroom management during the break between sessions. Subjects in the control group did not. While the subjects in both groups showed significant across-session decreases in inappropriate teacher interventions, the experimental subjects' decrease was much greater. (See Figure 2.)

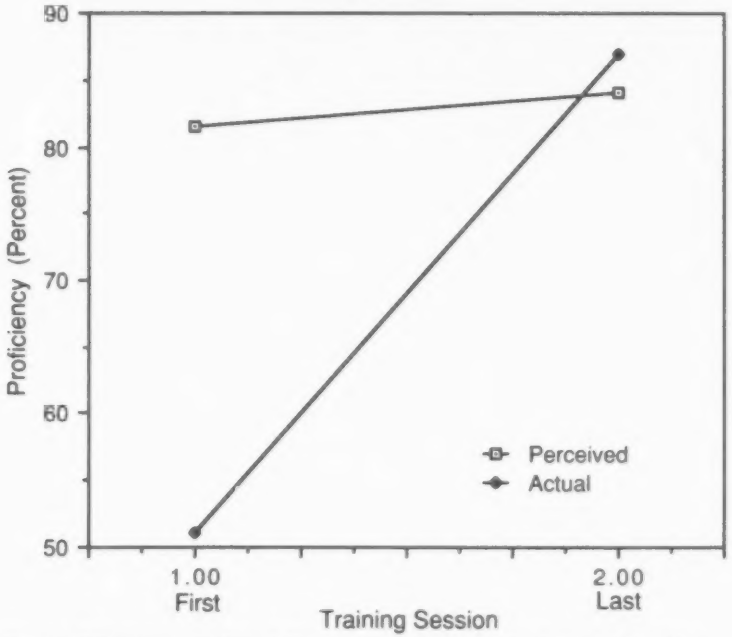
Figure 2
Percentage of Inappropriate Teacher Responses to Pupil Talkouts



Source: "Training Classroom Management Skills," In *Teacher Education and Special Education*, Harold R. Strang, et. al., 9, 60, 1986, Copyright 1986 by Special Press. Used with permission of Special Press and the Teacher Education Division.

Results from another study suggest that the simulations exert a powerful influence, not only on learning fundamental teaching skills but also on participants' awareness of their own skills. For example, an analysis of self-reports suggests that participants greatly overestimated their skill proficiency after completing their first teaching session. But, by the last session, their self-perceptions had become more realistic and did not differ significantly from their actual performance. (See Figure 3.)

Figure 3
Actual Versus Perceived Performance for First and Last Training Sessions



Source: "Microcomputer-Based Simulations for Training Fundamental Teaching Skills," in *Journal of Teacher Education*, Harold R. Strang, et al., January-February 25, 1987. Used with permission of the American Association of Colleges for Teacher Education.

What Do You Have To Send Others And How Do They Get It?

A complete simulation training package available for $22 (the cost of materials and shipping only), includes:

- Three floppy disks containing necessary programs and files. The Program Disk houses both the feedback and lesson-pacing modules. It offers users immediate access to skill-training sessions, for creating end-of-session feedback records and for writing lessons. The user may tap the Word Pool Disk directly to create individualized lessons. The Lesson Disk contains several demonstration lesson and pupil characteristics files.

- Two user manuals, one to guide the user in setting up the system and operating a simulation training session, the other to prepare professionals to conduct post-training counseling.

- Journal articles, conference presentations and exhibits by the project director, describing different uses for the microcomputer-based simulation.

The simulation is a relatively inexpensive technology, easy to use and ready for export to all interested teacher-training institutions. It is an economically feasible way to reinforce several fundamental teaching skills by integrating them into academic programs, either as adjuncts to lectures or to field experiences.

To acquire any of the above materials, write to:

Harold R. Strang
Curry School of Education
Department of Educational Studies
University of VA
405 Emmet Street
Charlottesville, VA 22903
804-924-7471

What Has Happened To The Program Since The Grant Ended?

The simulation has become the key laboratory component of a basic learning and development course which all teaching majors complete during their studies at the Curry School of Education. At this date, several hundred students have received individualized simulation training in both instructional and behavior management skills.

The University of Virginia supported the continuation of the simulation project during the 1987-88 academic year. For the 1988-89 and 1989-90 academic years, funds are being provided by the Commonwealth Center for the Education of Teachers. Future research will focus on creating increasingly realistic and versatile simulations based on observational data from actual classrooms, improving the simulations' visual and auditory capacities, and further validating the technology.

During the past several years, eight institutions other than the University of Virginia have begun using the teaching simulations. They are:

Bowling Green University
Capricornia Institute of Advanced Education (Australia)
James Madison University
Lehigh University
Luther College
Memorial University of Newfoundland (Canada)
University of Hawaii
University of Nebraska

In the spring of 1989, a new teaching simulation was created at the Curry School to accomplish many of the goals of its predecessors while appreciably reducing both hardware and system operator demands. Funds from a mini-grant awarded by the Commonwealth Center for the Education of Teachers allowed for the field testing of this simulation at four Virginia teacher-training sites during the 1989–90 school year.

* U.S. Government Printing Office: 1993-358-878: 36836